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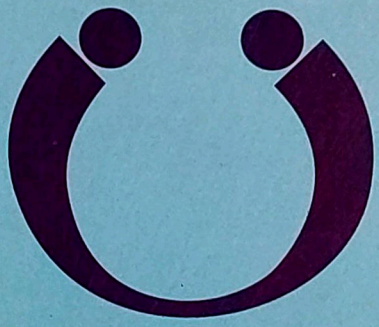

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Research Article

Prospective Study of Level of Serum Zinc In Patients of Febrile Seizures, Idiopathic Epilepsy and CNS Infections

Lalit Kumar, Om Shankar Chaurasiya, Aditya Hari Gupta

Department of Peadiatric M.L.B. Medical College, Jhansi - 284128

Abstract:

The present study was carried out to study serum zinc levels for it's prognostic significance as well as for it's role in pathophysiology of febrile seizures, idiopathic epilepsy and acute CNS infections. In the present study, 100 cases who were admitted in our hospital during March 2009 to August 2010, aged between 1 month to 18 yrs were selected on the basis of clinical history, physical and CSF examination. They were grouped as groupA (pyogenic meningitis), group B (febrile seizures), group C (idiopathic epilepsy), group D (other acute CNS infections), group E (cerebral malaria) and group F (control). Cases of cerebral palsy, neuroanatomical malformations, neurobehavioural disorders, neurodegenerative disorders and drug induced neurological manifestations were not included in the present study. Mean serum zinc level was significantly lower in groups A, B & E, while no significant difference was observed in group C & D as compared to the control. No significant difference in serum zinc level was detected in relation to outcome and degree of consciousness in any of the study groups.

Key Words: Serum zinc, Febrile seizures, CNS infections, Idiopathic epilepsy.

Introduction:

Zinc is one of the most important trace elements that is required for proper growth and health. Being a cofactor of over 200 enzymes and a structural protein in a large number of zinc finger proteins, zinc serves a wide range of roles in human body (Frederickson,1989). Zinc is an important trace element in biology. Role of zinc in cases of acute respiratory tract infections, chronic diarrhoea and severe protein energy malnutrition has been repeatedly proved in multiple studies (Walsh et al, 1994; Halsted & Smith, 1970; Sazawal et al, 1995). But there are only very few studies on zinc status in cases of febrile seizures, septic meningitis and epilepsy (Ehsanipour et al, 2009; Garty et al, l995; Mishra et al, 2007; Prasad et al, 2009) Available data regarding role of zinc level in infections are controversial.

In brain, zinc is present in synaptic vesicles in subgroup of glutaminergic neurons. In this form it can be released by electrical stimulation and may serve to modulate responses at receptors for number of different neurotransmitters. These include both excitatory and inhibiting receptors particularly NMDA (N-methyl-D-aspirate) and GABA (Gamma aminobutyric acid) receptors. This pool is 8% of total zinc content in brain.

Various workers have studied the levels of zinc in serum and cerebrospinal fluid in various CNS disorders and in normal controls. Burhanglu et al (1996) studied the role of trace elements in the pathogenesis of febrile convulsions. They studied serum Zn, Cu, Mg and cerebrospinal fluid (CSF) Zn, Cu, Mg and protein levels in patients with febrile convulsions, bacterial meningitis, viral CNS infections and in the control group. Mean serum and CSF zinc levels in the febrile convulsion group was significantly lower than in the other groups. A linear relationship was established between serum and CSF zinc level. Mean CSF zinc levels in bacterial meningitis group was significantly higher than in other groups. They suggested that in children with meningitis, the elevation of mean CSF zinc may result from breakdown of blood-brain barrier and subsequent leakage of trace elements and protein from serum to CSF. Pandey et al (1982) found the serum zinc levels to be significantly lower and CSF zinc levels to be significantly higher in patients with pyogenic meningitis as compared to controls. However, they concluded that it is not possible to predict that whether rectification of the deviant pools would benefit the patients or reduce the bioavailability of drugs administered.

There are conflicting evidences showing that at one hand zinc may act to attenuate GABA response and thereby elicit hyper excitability of neurons and induce seizure. Conversely, it has been found that zinc may act as an inhibitory neurotransmitter decreasing the likelihood of seizure (Mishra et al ,2007).

Prasad et al (2009) conducted study on CSF and serum Zn, Cu, Mg and calcium levels in children

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with idiopathic seizures with normal CT/MRI and abnormal EEG. Study concluded that zinc is essential for normal development of brain. Although, CSF and serum Zn levels in patients with seizure was found to be decreased, but it was statistically insignificant. Ganesh & Lalitha (2006) evaluated serum zinc levels on 38 previously healthy children of age between 3 months to 5 years admitted with simple febrile seizure along with control. The mean serum zinc level was significantly lower in children with febrile seizures as compared to controls.

A prospective analytical case control study had been conducted by Ehsanpour et al (2009) in which ninety two children aged 6 month to 5 years were divided into three groups : group A children with febrile convulsions, group B children having fever without convulsion and group C children with non-febrile convulsion. Serum zinc level of group A was lower than those of either of two groups ($p<0.006$). Most of the above studies suggests that during acute phase of febrile convulsion there is significantly increased IL-1 (interleukin1) and PG (prostaglandin) but decreased level of serum zinc.

Aims of the present study was to evaluate the role of Zn in seizure disorders and to evaluate Zn as prognostic indicator in patients of septic meningitis, and other acute CNS infections.

Materials and Methods:

The present study was conducted on 120 patients of 1 month to 18 years of age, admitted in pediatric ward of M.L.B. Medical College, Jhansi from March 2009 to August 2010. They were divided into Group A : Pyogenic meningitis; Group B : Febrile seizures; Group C : Idiopathic epilepsy; Group D: Other acute CNS infections, including viral encephalitis, meningoencephalitis; Group E :Cerebral malaria & Group F : Control. Children of control group were those who were not manifesting any neurological disease, admitted and recovered from other illness and had not suffered in past with convulsion or any neurological disease.

Exclusion criteria: Children with cerebral palsy, metabolic disorder affecting CNS, neuroanatomical malformation, neurobehavioural disorder, neurodegenerative disorder, drug induced neurological manifestation were excluded.

Serum zinc estimation: The estimation of serum zinc was done by calorimetric test kits provided by CREST Biosystems, in the department of Pathology, M.L.B. Medical College, Jhansi. Zinc in an alkaline medium reacts with Nitro PAPS(2-[5-NITRO-2-PYRIDXY-LAZO]-5[N-nPROPYL-{3SULFOPROPYL}] AMINO PHENOL DISODIUM SALT) to form a purple coloured complex. Intensity of this complex is directly proportional to amount of zinc present in the sample. This complex absorbs light at 570 nm wavelength using yellow filter.

Taking aseptic precaution, 2ml of blood from venipuncture using 22 gauge sterile needle, was collected within 24 hours of contact of patient both from case and control groups. The sample was then centrifuged for 3-4 minutes at 3000-4000rpm; serum thus obtained was collected and preserved at 2-8°C in sterile deionised plain vials. Estimation of Zinc was carried out within 7 days of collection.

Data obtained was analyzed by GRAPHPAD SOFTWARE. A difference between two values was considered to be significant only when 'p' value was found to be <0.05. The students' test (pooled test) was used to see difference between two groups.

Results:

All the patients were divided according to age in 3 groups as: <1year, 1-5 year and > 5 years as shown in Table I.

Table I: Age wise distribution of cases in various groups:

Age group	Group A N=20	Group B N=20	Group C N=20	Group D N=20	Group E N=20	Control Group F N=20
<1	8	11	0	1	2	17
1-5	8	9	3	8	5	3
>5	9	0	12	11	13	-

The mean serum zinc level in the control (group F) was found to be 120.0±37.79 µg/dl. This value was compared with mean values of various study groups (Table II). It was observed that mean serum zinc level was significantly lower in group A, B & E as compared to control ($p<0.05$), while no significant difference was seen in group C & D as compared to control. All the patients of study group were further subdivided into conscious group & a group with altered consciousness (Table III). No significant difference in mean serum zinc level between patients of conscious group & those with altered consciousness was observed except group D. In group D serum zinc level were significantly higher ($p<0.05$) in conscious group than those of altered consciousness.

In the present study no significant difference in mean serum zinc level was observed between patient who expired and those who were discharged, left against medical advice (LAMA) or absconded (Table IV).

Table II : Serum zinc levels in various groups in relation to control.

Study groups	Mean serum zinc level ±SD (µg/dl)	Degree of freedom	t-value	p-value
Group A (pyogenic meningitis)	70.9816±59.3974l	43	3.2256	0.0024 p<0.01
Group B (Febrile seizures)	79.55±40.8445	38	3.2669	0.0023 p<0.05
Group C Idiopathic epileps	140.4±71.0342	33	1.0811	0.2875
Group D (other acute CNS infection)	125.3985±83.4871	38	0.2439	0.80806
Group E (Cerebral malaria)	90.85±48.1956	38	2.1505	0.0379 p<0.05
Group F (control group)	120.0±37.795	-	-	-

Table III : Mean serum zinc level in various study groups in relation to level of consciousness

Study groups	Mean serum zinc level ±SD (µg/dl)		p-value
	Conscious	Altered consciousness	
Group A (pyogenic meningitis)	77.666±44.134 (n=6)	69.1863±57.848 (n=19)	0.7456
Group B (Febrile seizure)	77.69±41.40 (n=16)	87.00±43.62 (n=4)	0.6947
Group C (GTCS)	179.08±62.26 (n=13)	84.00±62.23 (n=2)	0.1920
Group D (Other acute CNS infections)	220.3633±190.216 (n=3)	108.52±42.0385 (n=17)	0.0281 P<0.05
Group E (cerebral malaria)	140.00±28.28 (n=2)	85.39±43.23 (n=18)	0.1241

Table IV : Mean serum zinc level in relation to outcome.

Study groups	Mean serum zinc level ± SD(µg/dl)		p-value
	Expired	Others (discharged, lama, abscond)	
Group A (pyogenic meningitis)	46.339±7.765 (n=3)	74.6155±56.9341 (n=22)	0.407
Group B (Febrile seizure)	54.00±36.77 (n=2)	82.39±41.22 (n=18)	0.365
Group C (GTCS)	84.40±62.23 (n=2)	149.08±62.23 (n=13)	0.1920
Group D (Other acute CNS infection)	130.666±60.04 (n=3)	124.35±88.46 (n=17)	0.9077
Group E (cerebral malaria)	64.00±39.00 (n=2)	93.83±48.10 (n=18)	0.4121

Discussion

In the present study serum zinc levels in pyogenic meningitis were significantly lower as compared to control (p<0.01; Table II). This is supported by the study of Pandey et al (1982) who also found serum zinc level to be significantly lower and CSF zinc levels to be significantly higher in patients with pyogenic meningitis as compared to control. Low serum zinc levels observed in cases of pyogenic meningitis may be secondary to disease process or it may be primary hypozincemia leading to septic meningitis. The reasons are multifactorial. First, during acute phase response in infections, zinc is redistributed from plasma to the liver & to lymphocytes . This is due to liberation of endogenous mediators from polymorphonuclear leucocytes which causes a net flow of amino acids and zinc to the liver for the synthesis of acute phase reactants including metalloenzymes, thereby causing hypozincemia. This is an adaptive response intended to deprive invading pathogens of zinc. Secondly, zinc may be utilized by the organisms for growth and multiplication (Allen et al 1983; Shankar & Prasad, 1998; Sugarma et al, 1982; Vallee, 1959).

In Febrile seizure, serum zinc levels were significantly lower as compared to control (p<0.05; Table II). This observation is consistent with previous studies by Burhanglu et al (1996); Ehsanipour et al (2009) and Ganesh & Lalitha (2006). The mechanism underlying febrile convulsion, which have multiple etiologic factors, are yet not clear. Some changes in levels of proinflammatory cytokines and zinc in serum and cerebrospinal fluid have been suggested to be responsible for pathogenesis of febrile convulsion .The reason for reduction of serum zinc levels in patients affected with febrile seizure is not known. However, fever and acute infections may have some role in developing such conditions. It is believed that the release of tumour necrosis factor (TNF) and interleukin during fever or tissue injury may result in reduction of serum zinc level. Izumi et al (1990) proposed that hypozincemia trigger the NMDA receptor which is one of the members of glutamate family receptor, may play an important role in initiation of epileptic discharge.

The serum zinc concentration in idiopathic epilepsy (Group C) was found to be slightly higher than control group but the difference was not statistically significant. This result is consistent with study of Prasad et al (2009) who also found no statistically significant difference in serum zinc levels in children with idiopathic seizure as compared to control. Role of zinc in seizure is controversial as at one hand, it plays a role in synthesis and function of inhibitory neurotransmitter GABA; on the other hand it also has inhibitory effect on GABA and thus facilitating seizure activity .

The serum zinc concentration in other acute CNS infections revealed no statistically significant difference as compared to control group (p>0.05),

which is consistent with study of Burhanglu et al (1996).

The mean serum zinc concentration in study group E (cerebral malaria) was found to be lower than that of control and this difference was statistically significant ($p<0.05$). This result was consistent with the study of Duggan et al (2005) who found low plasma zinc (<9.2mmol/l) in 70% of all subjects affected with cerebral malaria.

Pandey et al (1982) reported that CSF zinc levels as compared to controls was two fold higher in pyogenic, viral and tubercular meningo-encephalitis when the patient was conscious, but are augmented by five times in the comatosed subjects.

In the present study, in group A, B, C & E there was no significant ($p>0.05$) difference in serum zinc level in relation to level of consciousness. However, patients of altered consciousness in acute viral CNS infections group (group D) showed significantly lower serum zinc levels as compared to conscious patients. Serum zinc levels were lower in expired patient of each group as compared to patient who were discharged, absconded or lama. This is supported by the fact that magnitude of change in plasma zinc is related to severity and stage of infection . Fatal outcome indicates the uncontrolled infection and more of blood brain barrier damage resulting in leakage of zinc binding metalloproteins from blood to subarachnoid spaces so low serum Zn and high CSF zinc levels. However, the difference was not statistically significant.

Zinc level was found to be significantly decreased in febrile seizures in all previous as well as in present study. Since zinc levels were also found to be significantly low in patients with septic meningitis and cerebral malaria so better response may be expected if we supplement zinc preparation while continuing other treatment in all these diseases.

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Research Article

Effect of Lamotrigine on Fetal Rat Brain

Chhandamayee Mohanty, *Nilam Shah, *Shaligram Dhungel, **B K Das

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Abstract:

Studies on the effect of lamotrigine on fetal brain are limited. The present experimental study was conducted to explore any macroscopic or microscopic changes in fetal brain induced by lamotrigine. Pregnant albino wistar rats received 1.5 mg oral lamotrigine on day 9 to 11 of pregnancy and the pups were harvested on day 20. The mean body weight and length were lower and brain weight and volume were higher of the pups exposed to lamotrigine. However, the differences were not statistically significant. Some of the experimental pups had exencephaly and haemorrhages over the body. Histology of the brain revealed that in lamotrigine treated group, the lateral ventricles were dilated and the plexiform layer of the cerebral cortex was relatively less differentiated.

Key Words: Lamotrigine, Teratogenicity, Rat fetus, Brain defect.

Introduction:

Lamotrigine (LTG) is a second generation antiepileptic drug, widely used in the treatment of epilepsy and bipolar disorder. It is a phenyl triazine derivative and the mechanism of action is related to the blockade of voltage dependent sodium channels which stabilises presynaptic membranes and inhibit excitatory neurotransmitter release (Messenheimer 1995). Lamotrigine crosses the placenta easily and rapidly, therefore, the maternal treatment leads to a considerable fetal exposure (Myllynen et al, 2003; Ohman et al, 2000; Rambeck et al, 1997; Tomson et al, 1997). Though considerable numbers of pregnant women are exposed to LTG, sufficient data is not available concerning its teratogenicity. The present study has been carried out to evaluate the teratogenic effects of LTG on fetal rat with special reference to brain development.

Material and Methods:

Albino wistar rats weighing between 150-200 gm were used. Females showing proestrus at 17.00 hrs were caged overnight with males of the same stock. When spermatozoa were found in the vaginal smear in the next morning at 09.00 hrs, it was taken as day 0 of gestation. The pregnant animals were kept individually in separate cages under controlled environmental conditions. The experimental group of rats were administered LTG in the dose of 1.5 mg orally using nasogastric tube on day 9, 10 and 11 of pregnancy. The control rats received only tap water. Pregnant rats were sacrificed on day 20 of gestation and the fetuses were collected after noting the resorption sites and dead fetuses. The live fetuses were cleaned, blotted, weighed and were examined under dissecting microscope for various external malformations. The fetal brain was dissected from the cranial cavity and was preserved in formal saline for histological examinations.

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Results:

Sixty pups delivered from 12 rats in the experimental group and thirty delivered from 6 rats in the control group were studied. The values of the morphometric parameters are shown in Table 1. Though the mean body weight and length of the LTG treated pups were lower as compared to the control group, the difference was not statistically significant. Similarly, the mean brain weight and volume of the LTG exposed rats was higher, but statistically it was comparable to control values.

Some of the LTG exposed rat foetus had well defined dark brown swellings over parieto-occipital region of head (exencephaly). Hemorrhages of various sizes were found over the body; especially over the cervicothoracic junction. None of these findings were found in the control fetuses.

The ventricles of the experimental pups were larger than that of the control pups (Fig.I & II). Histologically, the plexiform layers in the experimental rat pups were relatively less clearly defined (Fig. III).

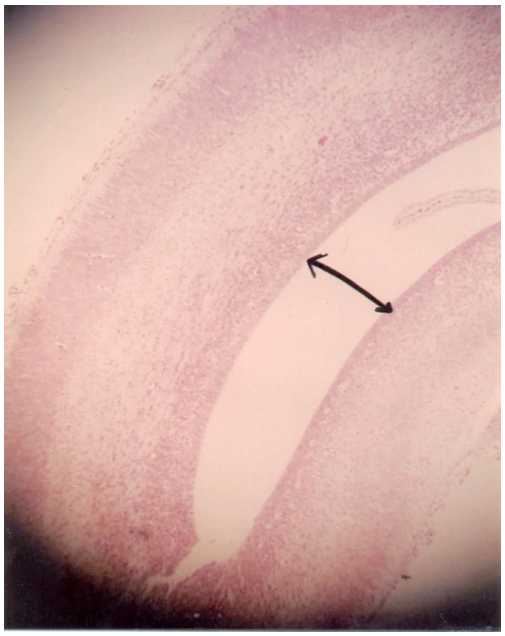

Fig.I: Lateral ventricle (arrow) is larger in Lamotrigine treated rat fetus as compared to control (H & E x 40).

Fig.II: Control rat fetus showing normal sized ventricles (arrow) (H & E x 40).

Table 1: Morphometric parameters (Mean ± S.D.) of the rat pups.

Parameters	Experimental	Control n = 60	p-value n = 30
Body weight (g)	2.29 ±0.25	2.34±0.34	0.39
Body length (cm)	2.77±0.40	2.93±0.5	0.90
Brain weight (g)	0.12±0.024	0.11±0.024	0.34
Brain volume (ml)	0.15±0.03	0.14±0.03	0.19

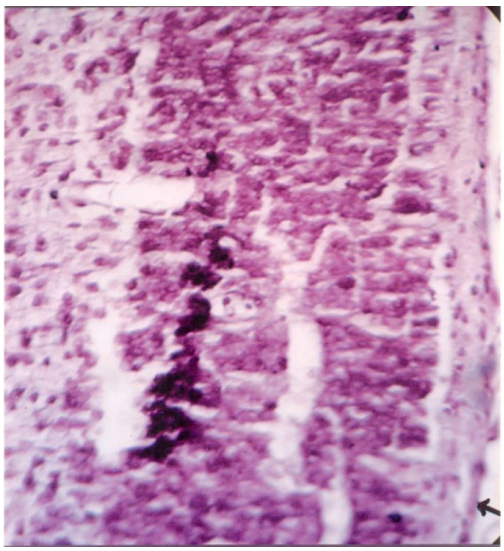

Fig.III: Histological section of cerebral cortex showing less clearly defined plexiform layer in Lamotrigine treated rat fetus (H & E X 400).

Discussion:

In our experimental study, offsprings of LTG treated rat demonstrated relatively lower body weight and length with higher brain weight and volume. Some of these fetuses had exencephaly and haemorrhages over the body. Histologically, the ventricular size was larger in LTG exposed rat fetus with less differentiated plexiform layer. de Marchi et al (2001) treated pregnant rats with four times the recommended human dose of LTG during the period of organogenesis and reported low birth weight and altered brain structure which included increased volume and diameter of the cerebral structure, increased density of the subcortical layer and ventricle dilatation. Padmanabhan et al (2003) reported that administering LTG as single dose of 50-200 mg/kg body weight can induce intrauterine growth retardation in mice, whereas multiple doses of 25, 50, 75 mg/kg body weight caused a dose dependant increase in embryonic resorption and craniofacial malformations. Rahmani et al. (2006) studied the teratogenic effects of lamotrigine on mouse fetus and noted reduction of body weight and height with increased malformations of vertebral columns and limbs. Rats receiving up to 0.5 times an equivalent human dose of 500 mg/day produced offspring with decreased folate concentrations, an effect known to be associated with teratogenicity in human and animals (Iqbal et al, 2001). However, the authors did not find teratogenic effects in animals by using increasing doses up to 1.2 times the human dose.

The data derived from human studies remains inconclusive. However, most of the human pregnancy registry studies could not reveal clear cut evidence of a relationship between LTG and teratogenesis. They concluded that LTG monotherapy during pregnancy to be relatively safe (Gentile, 2006; Ornoy, 2006; Richens, 1994; Vajda et al, 2006). However, major congenital malformations like neural tube, cardiac, gastrointestinal, hypospadias/genitourinary defects and other defects has been reported in offspring of women treated with LTG in pregnancy and most of them were receiving LTG in significantly higher dose as compared to those without major congenital malformations (Meador et al, 2006). Similar was the observations of Perucca (2005) who identified a positive correlation between maternal dose and frequency of major congenital malformations. Several authors suggested that LTG may be less teratogenic to humans as compared to other antiepileptic drugs (Sabers et al, 2004; Tatum, 2006; Tomson et al, 1997) and most of the major malformations were similar to that in the general population (Morrow et al, 2006).

Results obtained from animal study may not be directly applicable to human beings. One of the various factors that influence outcome is the dose. In most animal studies, the dose used was higher than that in human. Secondly, the metabolism in human body may be somewhat different from animals. Though this animal study does not show significant gross morphometric effect of LTG, some histological changes were observed. Therefore, LTG should not be regarded totally safe drug during pregnancy until its safety is established in a large scale randomised study with long term follow-up.

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Research Article

Comparison of Graphoanalysis with Blum's Method in Prediction of Complete Denture Patient's Mental Attitude - A Prospective Comparative Study

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Abstract:

Understanding mental attitude is one of the most important factor in the diagnosis of prosthodontic patients. Prosthodontist must fully understand their patients as it helps the patients to accept the kind of treatment they need. As a correlation exists between emotional state and handwriting, therefore, using the concept of graphoanalysis in complete denture patient, they were categorized based on their handwriting analysis into having realistic or unrealistic expectations thereby, helping dentists in dealing with their patients better.

Key Words: Complete denture treatment, Graphoanalysis, Blum's classification.

Introduction:

The success of a denture is related to many factors which include technical procedures, functional factors, esthetics, biologic determinants and psychological factors. Psychological factors include the preparedness of the patients and their mental attitude towards denture; their relationship with and attitude towards the dentist, their intelligence and ability to learn how to use the dentures. There are various methods for evaluating complete denture patient's behaviour. Some of them are as follows:

Cornell medical Index is a health questionnaire used to obtain a large amount of relevant medical and psychiatric information. Psychological testing (psychometrics) is a field characterized by the use of behaviour samples to assess the cognitive and emotional functioning of an individual. Denture adjustment inventory is used to assess mental health problem in psychiatric and medical settings. Diagnostic denture is used to prevent denture disaster as it is used for analyzing, refining and confirming clear speech and correct jaw relations. House classified patient's psychology into four types as philosophic, exacting, hysterical and indifferent. Blum classified patient's psychology as reasonable/realistic and unreasonable/ unrealistic (Potgeiter & Carey, 1983).

Handwriting analysis can play an important role whenever it is useful to know something about human personality. It can be of use in personnel selection, compatibility analysis, career guidance, assisting lawyers and law enforcement agencies; enabling teachers to identify the strengths, weaknesses, aptitudes of students; supporting social workers and counsellors in identifying and dealing with their client's behaviours and personalities and diagnostic procedures in medical field.

Graphology is described as a scientific study and analysis of handwriting, or the art of interpreting character and personality from peculiarities in handwriting (Gardner, 1997).

According to Webster's dictionary, graphology is the study of handwriting for the purpose of analyzing a person's character or personality .No one knows for sure where or when it started. Some speculate that it started soon after handwriting was invented. The earliest written references were found in the writings of Aristotle (Gardner, 1997) where some of his observations about cursive writing were interpreted as commentary on handwriting analysis (Dennis, 2001). The science of graphology has for many years been a tool to increase awareness of one's character or personality.

However, the first serious treatise on handwriting analysis was written in 1622 by Camillo Baldo, an Italian physician and a Professor at the University of Bologna (Dennis,2001). He wrote the first known book on graphology which was titled "How to Judge the Nature and the Character of a Person from his letter". He commented on the fact that all writers write differently and that no one can write like another.

Handwriting is essentially a brain writing, the pen is merely a tool, directed through the movement of arm by impulses that originate in the cerebral cortex. The message is sent via the nervous system to arms,

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hands and even toe muscles, which motivate the pen to produce the symbols we call writing.

On the surface, handwriting styles may appear to be the same, especially among family members. Generally, in such cases, the superficial resemblance is due to common traits, which are often reinforced in family or communal structure. Conscious or unconscious attempts to emulate style can always cause a similarity in scripts. The significant differences of personality, however, will always be revealed by a detailed handwriting analysis.

An attempt was made in this study to evaluate whether there is any relationship between graphoanalysis and denture expectations of the patient. The subjects were classified according to Blum's classification and analysis was done to find whether there is any influence of age or sex on a patient's expectations from denture.

Material and Methods:

Part - I: Fifty consecutive complete denture patients attending as out patients in the Postgraduate Department of Prosthodontics, Mahatma Gandhi Postgraduate Institute of Dental Sciences, Pondicherry, who knew to write in English and Tamil (prevalent language) were selected for the study. The age group of the subjects varied from 38 to 84 years. Out of 50 subjects, 40 were males and 10 were females.

Subjects were explained about the study and their consent was obtained. They were asked to write down what their expectations were from the treatment modality in few lines on one unruled white page and some other matter comprising three pages in English or Tamil in their own handwriting. They were asked to write only on one side of the paper to avoid superimposition. They were asked to use the pen which they were comfortable with. Routine case history was taken and treatment procedures were completed as required and the patients were evaluated and categorised based on clinical experience during treatment according to Blum's classification who divided patients into two types as realistic and unrealistic. Analysis was done to find out influence of age and sex on it.

Blum in 1960 suggested a scheme for classifying patients as reasonable or unreasonable, realistic or unrealistic (Sharry, 1974). According to him unreasonable patient have:

1. Unreasonable expectations towards the doctor and medical science with regard to the quickness and certainity of diagnosis and treatment and with regard to the power and selfless benevolence of the physician.
2. Unreasonable expectations about the fee and a basic unwillingness to pay unless completely satisfactory results are obtained.
3. Unreasonable beliefs about the general incompetence or unpleasant and untrustworthy nature of physicians in general.
4. Under careful inquiry, unreasonable patients often will be able to recognize and admit to themselves problems such as nervous tension, superstition, oversensitivity, fearfulness, overcritical nature, weakness of will, frequent sadness, perfectionistic tendencies and occasionally stupidity. Their social backgrounds are similar.
5. In general, unreasonable persons are less educated than reasonable ones and are more frequently labourers, whitecollar workers or skilled and semiskilled workers. In contrast, reasonable patients more often hold professional and managerial jobs.
6. The unreasonable patients usually have lower incomes than reasonable ones. Unreasonable persons are most often in the lower and lower-middle classes and reasonable persons are more often from the upper and upper-middle class groups.

Part – II: The handwriting samples were submitted for graphoanalysis. The graphoanalyst was not given any details about the subjects. The samples were numbered and sent to him. He was given the criteria for classifying subjects according to Blum's classification. Graphoanalyst used magnifying glasses; emotional gauge/slant gauge and grid recomended by the International Graphoanalysis society to measure angle between the baseline and slant line for analysis of handwriting (Fig I). The detailed analysis of the basic strokes is what enables a graphologist to analyze the writing of an individual of any nation, the analyst need not know the language. The strokes are the same in all languages.

Handwriting is comprised of many diverse elements like various strokes, such as i dots, hooks, t bars and loops which are connected together to form letters, words and sentences. When analyzed, these strokes can be decoded to reveal any or all of the aspects of personality. The importances of diverse elements of handwriting are as follows: t bars - the

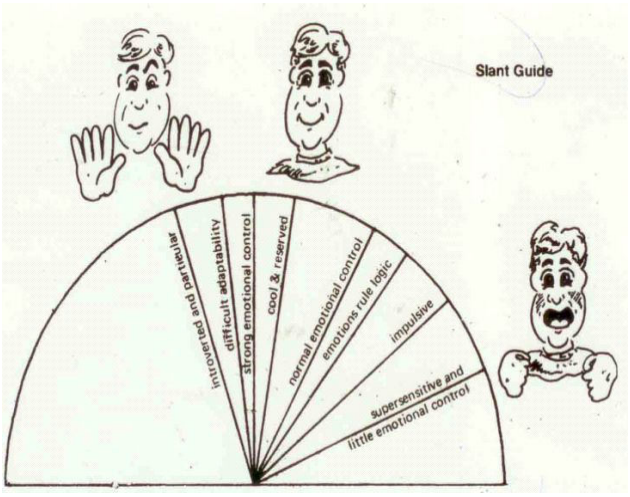

Fig. I: Emotional gauge which is used for measuring angle between the baseline and slant line.

placement of the bar on stem represents goal orientation (higher the bar, higher the goals). The sweep of t bar shows the enthusiasm level, the longer the bar sweeps from the left to right, the more the enthusiasm. The i-dots indicate ability to pay attention to details. The well placed dot indicates good attention to details whereas dot placed away indicates less attention to details. No dots indicate lack of enthusiasm, whereas rounded dot indicates loyality. On analyzing various loops, upper loops denote capacity for abstract thought whereas lower loops denote capacity for creativity and imagination. Slants reveal the degree to which an individual expresses the emotional feeling to others. Slanting to right is to express the real emotional feeling (extrovert). Writing vertically is to be objective and relies on judgement and logic emotional feeling. Slanting to left indicates repressal or withholding of emotions. On analyzing hooks-initial hooks indicate desire to acquire things and final hooks indicates tenacity. Amount of pressure applied while writing reveals mental energy level and stress level. Rhythm of writing denotes fluid thought and mental discipline, similarly margins and spaces denote extravagance if much space is left while writing and frugality if page is filled up. Wedges represent that writer is good at research and enjoy searching answers. Retracing of letter while writing show repressed thoughts, feelings or emotions (Fig. II a-h) Moving on to zones the dominating zone indicates that the writing is taller or more elaborate in that particular zone. Dominating upper zone denotes intellectual or abstract, middle zone denotes daily action or tangible and lower zone denotes desire, drives or biological (Fig. III a-c).

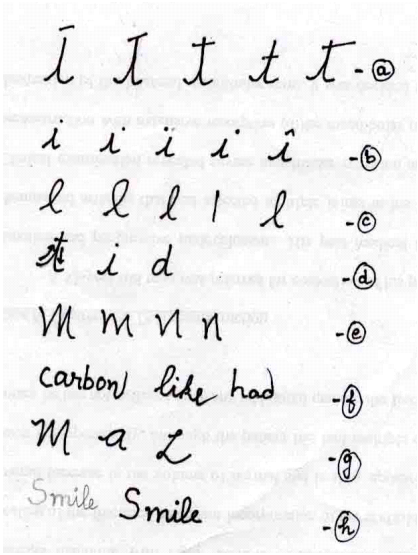

Fig. II: Showing handwriting diverse elements as : (a) t-bars represents goal orientation and enthusiasm level;(b) i-dots indicate attention to details;(c) loops denote abstract thoughts;(d) retracing shows repressed emotions;(e) wedge represents writer's interest in research; (f) ending strokes indicates social attitude; (g) hooks denote desire to acquire things;(h)pressure indicates mental energy level.

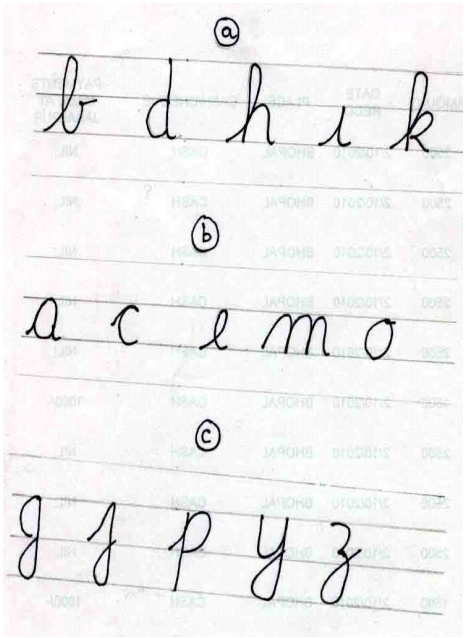

Fig. III: Shows details of dominating zone:(a) upper zone denotes ability to conceptualize;(b) middle zone denotes daily action;(c)lower zone imagination and creativity

Results:

The present study evaluated the expectations, attitudes and reactions of the patients before, during and after treatment by clinical experience and compared this with emotional and behavioural patterns predicted by graphoanalysis (analyst's report). Table I shows classification of subjects according to clinical

experience (Blum's classification). It was observed that total number of patients with realistic expectations were more than the unrealistic.

The age range of the patients observed varied from 38 to 84 years. To see whether there was any relationship between age of patient and he/she being realistic/unrealistic, the categorisation of subjects was done.

Patients were categorised as those below 60 years (n=31), 60 years and above 60 years (n=19). Among patients below 60 years, 87.1% were realistic & 12.9% were unrealistic; while in patients of 60 years & above, 63.2% were realistic & 36.8% were unrealistic (Table II). The above relationship is statistically upheld as the calculated chi-square value, 3.93 is significant at 5 per cent level (3.93 is greater than 3.84, the table value for 1 degrees of freedom at 5% level). Mann-Whitney 'U' Test was done to find out comparison between the groups below 60 years and 60 years and above shows that the rank sum of below 60 years age group was more than that of above 60 years age groups and the difference between the rank sum was highly significant at 5 per cent level. That is, one can be 95 per cent confident that the classification of patients into realistic and unrealistic differs significantly between two age groups (Table III).

Table IV shows the influence of sex on Blum's classification. Among the study group, 77.5% of males and 80% of females were realistic while 22.5% of males and 20% of females were unrealistic. The calculated Chi-square value of 0.029 was not significant (Table IV). Mann-Whitney 'U' Test was applied to find out comparison between males and females, which showed that there was no significant difference in classification of realistic and unrealistic between males and females. The rank sum for male groups was more than that of female groups but the difference was insignificant. That is, probability of getting realistic and unrealistic level would be nearly equal between male and female patients (Table V).

Table I: Classification of subjects according to clinical experience.

Expectation	Number of patients
Realistic	39
Unrealistic	11
Total	50

Table II: Influence of Age (Below 60 years, 60 years and above 60 years) on Blum's classification

Classification	Age		All Sample
	< 60 Years	≥ 60 Years	
Observed frequency (clinical experience)			
Realistic	27 (87.1%)	12 (63.2%)	39 (78.0%)
Unrealistic	4 (12.9%)	7 (36.8%)	11 (22.0%)
Expected frequency (graph analysis)			
Realistic	24 (77.42%)	15 (78.94%)	39 (78.0%)
Unrealistic	7 (22.68%)	4 (21.06%)	11 (22.01%)
Calculated χ^2 Value		3.93	
Degrees of freedom		1	
Result	Significant at 5 % level		

Chi-square table value for 1 degrees of freedom @ 5% = 3.84 and @ 10% = 2.70

Table III: Results of Mann-Whitney 'U' Test (Below 60 years,60 years and above 60 years)

Age	N	Rank Sum	Mann-Whitney 'U' Value	'Z' Value	Results
< 60 years	31	720	224	1.96	Significant at 5% level
≥60 years	19	555			

Discussion:

Silverman et al (1976) stated that the emotional level would assist the dentist in anticipating the frequency and intensity of problems and concluded that a warm, sympathetic and understanding approach to the patient could serve to reduce time, effort and mental anguish, thereby permitting better dental service for the patient. Zeng et al (1999) stressed that the prosthodontists not only need improving technological quality of prostheses but also need to pay attention to patient's psychological characteristics as these personality factors affect the denture satisfaction in every aspect of the denture. Grieder (1973) concluded from a research that, to understand patients, sound knowledge of some foundations of human behaviour is essential along with emphasis on man's accumulation of stress, and its effect upon him orally in relation to prosthodontics.

Graphology is a self-validating science (River, 2003). This means the credibility of the method can be proven immediately by the feedback obtained from the graphologist. Validation of handwriting analysis has also come from the scientific community itself. Various comparisons have been made between psychological tests and graphology with the same caliber of information revealed by both. In many cases, in fact,

Table IV: Influence of sex on Blum's Classification.

Classification	Sex		All Sample
	Male	Female	
Observed frequency (clinical experience)			
Realistic	31 (77.5%)	8 (80.0%)	39 (78.0%)
Unrealistic	9 (22.5%)	2 (20.0%)	11 (22.0%)
Expected frequency (graph analysis)			
Realistic	31 (77.5%)	8 (80.0%)	39 (78.0%)
Unrealistic	9 (22.5%)	2 (20.0%)	11 (22.0%)
Calculated χ^2 Value		0.029	
Degrees of freedom		1	
Result		Not significant	

Chi-square table value for 1 degrees of freedom @ 5% = 3.84 and @ 10% = 2.70

Table V: Results of Mann-Whitney 'U' Test (Influence of sex)

Sex	N	Rank Sum	Mann-Whitney 'U' Value	'Z' Value	Results
Male	40	1025	195	0.169	Not Significant
Female	10	250			

handwriting analysis proved to be more thorough and effective in assessing behavioral patterns than standard psychological tests (River,2003).

In the present study, fifty complete denture patients were selected as subjects and observations were subjected for statistical analysis. This was not in conformity with Crumbaugh & Stockholm (1977), who stated that subjectivity of graphoanalysis makes statistical analysis difficult.

The selection of patients was random without any preformed idea about them, which is not in conformity with a study done by Potgeiter & Carey (1983), wherein three patients taken as subjects in their study were referred by other practitioners because they were difficult patients.

Patients were asked to write their expectations to classify them as realistic and unrealistic. Subjects who could write in both English and Tamil were chosen and were asked to write in their own handwriting on the white papers provided by us. The idea behind providing paper was to maintain uniformity. They were asked to write with the pen which they were comfortable with, to avoid any change in their handwriting because of the change in pen. They were asked to write three pages of matter so that at some point they will not be conscious in writing and would write in their usual manner. They were asked to write their expectations from the treatment in one page so that they could be categorised according to Blum's classification (realistic/ unrealistic).

The handwriting sample of all the fifty patients was sent for graphoanalysis. The analyst was not given any information about the subjects thus avoiding any bias in the results and they were classified according to Blum's classification based on their handwriting as realistic and unrealistic with the help of classification sent by us. The patients were also categorised according to Blum's classification based on clinical experience during treatment. This is in conformity with the study done by Potgeiter & Carey (1983) who evaluated three patients by graphoanalysis and compared it with their expectations, attitudes and reactions during course of treatment.

The subjects were classified according to Blum's classification (Sharry,1974) based on the clinical experience during treatment, their expectations which they wrote and also taking their age and sex into concern, as realistic or unrealistic. The observations were tabulated and subjected for statistical analysis. The fifty subjects chosen for study included 40 males and 10 females. Both the sexes were included in the study to avoid any bias and also to find the influence of sex on the observations. It was found that with regards to sex, the probability of being realistic or unrealistic was found to be nearly equal between male and female patients. This is in conformity with a study of Langer et al, (1961) which showed that statistical evaluation of satisfaction and dissatisfaction showed no significant differences between men and women, indicating that both sexes reacted similarly towards their complete dentures.

The age range of subjects varied from 38 to 84 years. The observations were categorized as those below 60 years and 60 years and above, were subjected for statistical analysis. It was found that age had a significant influence on a patient being realistic or unrealistic. It was found that incidence of unrealistic cases were more in subjects above 60 years.

Thus, it was found that graphoanalysis is an useful tool for identification of patient being realistic or unrealistic. Classification or categorization of patients by graphoanalysis and by clinical experience of patients differs significantly and graphoanalysis when coupled with clinical experience is more helpful in identification of difficult patients than merely by clinical experience alone. Age unlike sex, has a significant influence on a patient being realistic or unrealistic.

Although, graphology does pinpoint behavioural traits, it cannot be used to deduce information regarding age, sex, race or nationality and even the writing of

handicapped individuals who may use their teeth or toe to communicate (River, 2003).

Conclusion:

By evaluating subjects by graphoanalysis, clinical experience and statistical analysis, it was concluded that Graphoanalysis is a useful tool in ascertaining difficult patients and when coupled with clinical experience it is more helpful in identifying patients than merely from clinical experience alone. It was found that age has a significant influence on a patient being realistic or unrealistic, as patients 60 years and above 60 years were found to be more unrealistic than patients below 60 years. Sex does not seem to have significant influence on patients being realistic/ unrealistic and probability of getting realistic and unrealistic would be nearly equal for both male and female patients.

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Research Article

Anatomical Variations in Formation and Branching Pattern of the Femoral Nerve in Iliac Fossa: A Study in 64 Human Lumbar Plexuses

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Abstract:

Femoral nerve is used for nerve block in several surgeries and is vulnerable to compression in tight ilio-psoas compartment. The knowledge of origin and variations of femoral nerve in iliac fossa is important for anatomists, anesthetists and surgeons to prevent iatrogenic femoral nerve palsy.

We dissected 32 human cadavers to study the anatomy of the femoral nerve. We dissected the lumbar plexus bilaterally; dissected the psoas major muscle to see formation of the femoral nerve. We measured the length of the femoral nerve from its formation to inguinal ligament; and recorded variations of the femoral nerve with digital photography.

The average length of the femoral nerve was 144 mm. Anatomical variations of the femoral nerve were found in 25% lumbar plexuses. These variations included abnormally long L2 root, early division of the femoral nerve, origin of lateral cutaneous nerve of thigh from the femoral nerve, origin of nerve to pectineus from the femoral nerve in iliac fossa, splitting of the femoral nerve into two slips by psoas major or accessory slips of iliacus muscle.

The aim of this study was to highlight variations in branching pattern of the femoral nerve in iliac fossa for appropriate exposure of the femoral nerve.

Key Words: Anatomical variations, Femoral nerve, Iliacus muscle, Nerve block, Psoas major muscle.

Introduction:

The femoral nerve is the largest branch of the lumbar plexus. It arises from the dorsal branches of second to fourth ventral rami. Conventionally the femoral nerve passes behind the inguinal ligament and divides into anterior and posterior divisions in the thigh (Newell, 2005). The femoral nerve block is performed on the main trunk of the femoral nerve just below the inguinal ligament (Ellis et al, 2004). The higher division of the femoral nerve in iliac fossa results in incomplete femoral nerve block.

Variant origin of the femoral nerve branches has wide clinical relevance. Nerve to pectineus arises from medial aspect of the femoral nerve near the inguinal ligament, passes behind the femoral sheath and enters the anterior aspect of the muscle (Newell, 2005). Origin of nerve to pectineus from the femoral nerve in iliac fossa and absence of nerve supply to pectineus either from obturator nerve or accessory obturator nerve is more important morphologically than clinically. Origin of lateral cutaneous nerve of thigh from the femoral nerve may confuse the practitioner in treatment of meralgia paraesthetica.

Aberrant slip of iliacus or psoas major muscle sometimes splits the femoral nerve (Spratt et al, 1996; Vazquez et al, 2007; Anloague & Huijbregts, 2009). The detailed knowledge of the possible variations of these muscles and femoral nerve may have immense importance in various pelvic and pelvi-femoral surgeries.

The objective of this study was to dissect, identify and document variations in the anatomy of the femoral nerve and its branching pattern in iliac fossa. This knowledge could then be used to validate previously described anatomy of ilio-psoas compartment and various surgical approaches to expose the femoral nerve.

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Materials & Methods:

Variations in branching pattern of the femoral nerve in thigh have been widely reported in literatures. Variation of origin and branching pattern of the femoral nerve in iliac fossa has wide clinical implications.

The femoral nerve was studied during routine educational dissection of 32 human cadavers of Asian origin in the department of anatomy over a period of three years. There were 24 male and 8 female cadavers with mean age of 48 years. There were no signs of trauma, surgery or wound scars in the abdominal regions of any of the cadavers.

The skin, superficial fascia, muscles of anterior abdominal wall and all abdominal viscera were removed to expose the posterior abdominal wall. The exposure of origin of femoral nerve was done by removing psoas

major muscle piece by piece.

The lengths of the L2, L3 and L4 roots from corresponding intervertebral foramen to the formation of the femoral nerve, and length of the femoral nerve from its formation to the point where it passed deep to the inguinal ligament was measured with a thread which was measured with a scale (Table I). The epineurium of the L2, L3, L4 roots, of the femoral nerve and of the nerve to pectineus were opened to find the contribution of femoral nerve, obturator nerve or accessory obturator nerve, if present, to supply the pectineus muscle; we traced the fascicles in nerve to pectineus back into trunk of the femoral nerve.

The variations in the formation and branching pattern of the femoral nerve were recorded; and it's varied relationship to the ilio-psoas complex, if any, was photographed and documented.

Since the hip joints were disarticulated before the dissection of lumbar plexuses, so we did not study the branching pattern of the femoral nerve in the thigh.

Results:

After careful dissection of the psoas major muscle, we exposed L2, L3 and L4 roots of the femoral nerve. We measured the lengths of L2, L3, L4 roots, and of the femoral nerve.

We found that lengths of roots of femoral nerve reduced from L2 to L4. Abnormally long L2 root (92 mm in a cadaver) resulted in very short course of femoral nerve (35 mm) in the iliac fossa (Table I).

Table I: Showing length of lumbar roots and of the femoral nerve.

Roots and FN	Length landmarks		Mean length (range) mm
	From	To	
L2	IVF between L2 & L3	Formation of FN	34 (28-92)
L3	IVF between L3 & L4	Formation of FN	20 (18-25)
L4	IVF between L4 & L5	Formation of FN	18 (15-20)
FN	Formation of FN	The point where FN passes below IL	144 (35-149)

Femoral nerve (FN), intervertebral foramen (IVF), inguinal (IL) ligament

We recorded anatomical variations such as abnormally long L2 root, early division of the femoral nerve, origin of lateral cutaneous nerve of thigh directly from the femoral nerve, origin of nerve to pectineus in iliac fossa and splitting of the femoral nerve by psoas major or accessory slip of iliacus muscle with digital photography. We noted the variations in the formation and branching pattern of the femoral nerve; and its varied relationship to the ilio-psoas complex in 16 of the 64 (25%) of the lumbar plexuses dissected.

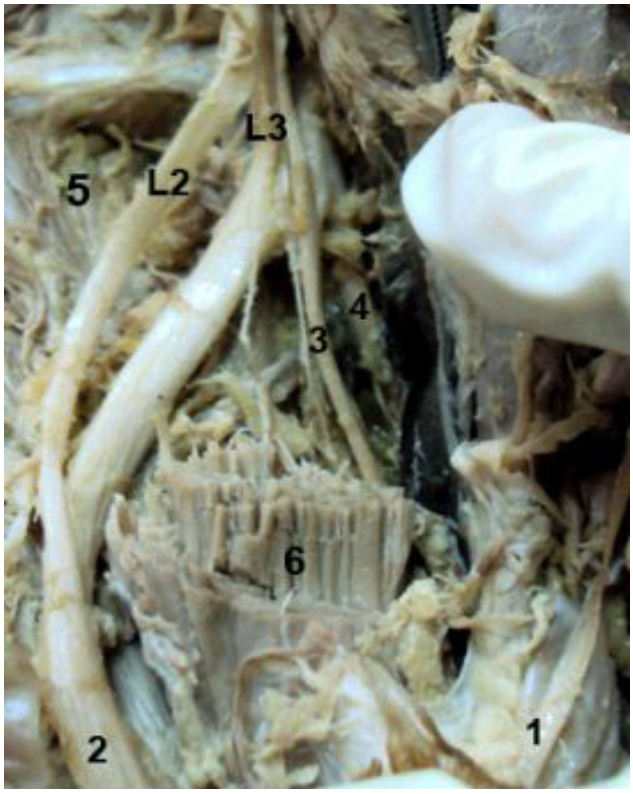

Fig. I Abnormally long L2 root fused with combined L3 & L4 roots 35 mm above the inguinal ligament. 1 inguinal ligament cut, 2 femoral nerve, 3 obturator nerve, 4 lumbosacral trunk, 5 iliacus, 6 psoas major

We found abnormally long L2 root on both sides in a male cadaver. On the right side, it was 92 mm long. After emerging from intervertebral foramen between L2 and L3 vertebrae, it divided into ventral and dorsal divisions. The ventral division fused with ventral divisions of L3 and L4 roots to form obturator nerve; and the dorsal division of L2 descended in iliac fossa and fused with combined dorsal divisions of L3 and L4 to form the femoral nerve 35 mm above the inguinal ligament (Fig.I). On the left side L2 root was 85 mm long, had the same course as on the right side, and it fused with combined dorsal divisions of L3 and L4 to form the femoral nerve 42 mm above the inguinal ligament.

We found early division of the femoral nerve in two lumbar plexuses. In a right lumbar plexus of a male cadaver, the femoral nerve divided in iliac fossa 40 mm above the inguinal ligament into anterior and

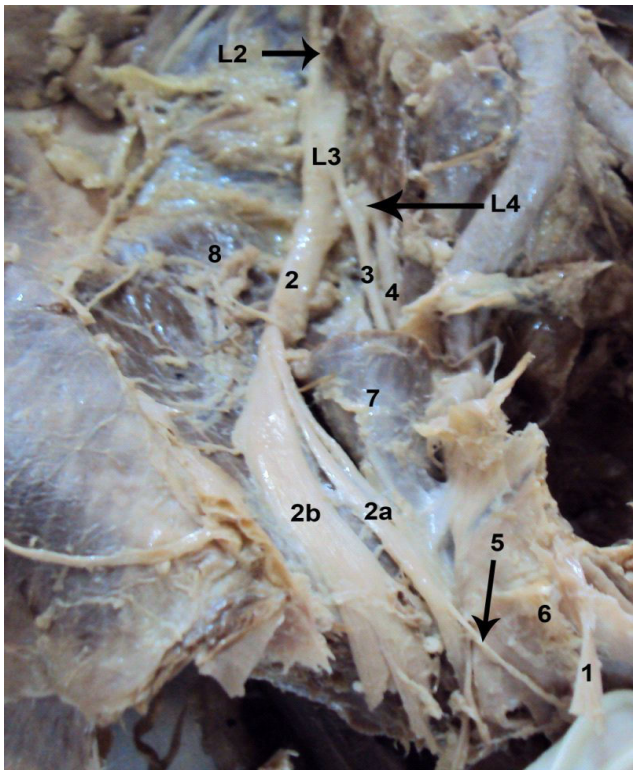

Fig.II: Early division of the right femoral nerve in iliac fossa. Nerve to pectineus arising from anterior division behind the inguinal ligament. 1 inguinal ligament cut, 2 femoral nerve, 2a anterior division of femoral nerve, 2b posterior division of femoral nerve, 3 obturator nerve, 4 lumbosacral trunk, 5 nerve to pectineus, 6 pectineus, 7 psoas major cut, 8 iliacus.

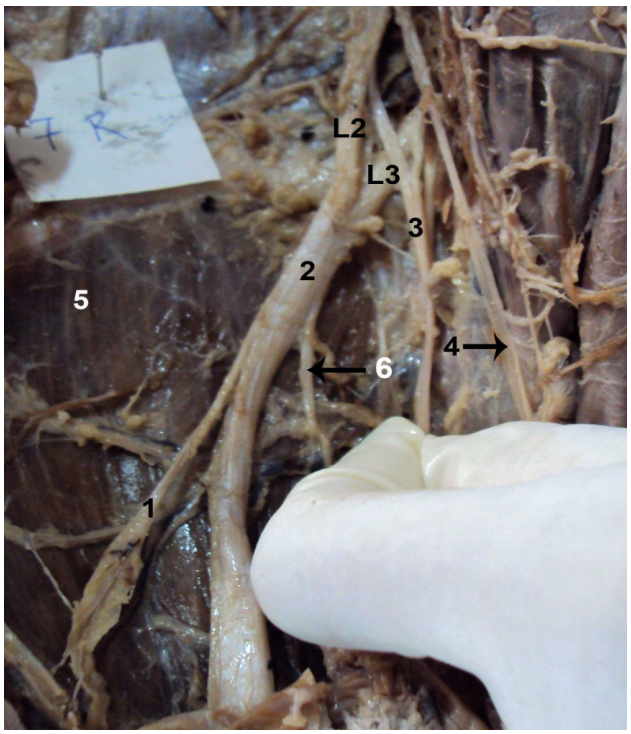

Fig.III: Right lateral cutaneous nerve of thigh arising from the femoral nerve. 1 lateral cutaneous nerve of thigh, 2 femoral nerve, 3 obturator nerve, 4 nerve to psoas major, 5 iliacus, 6 nerve to iliacus

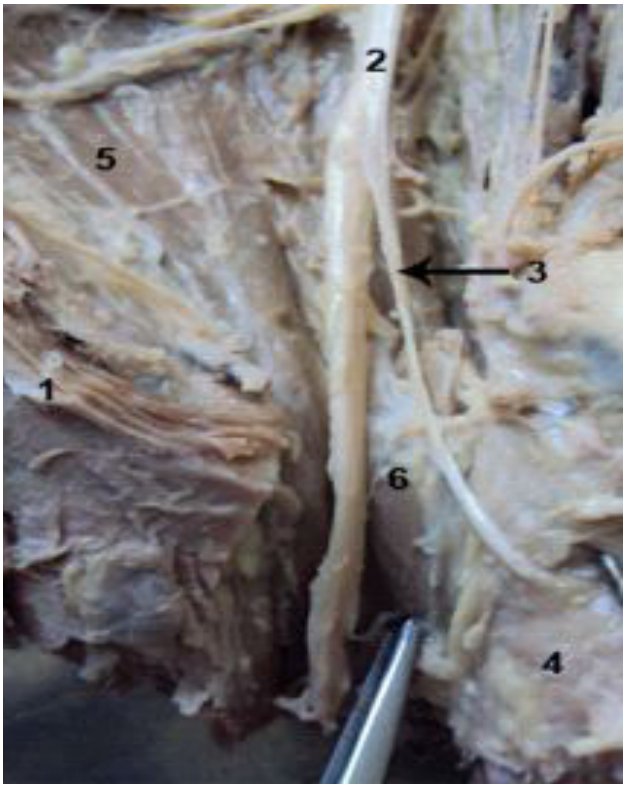

Fig.IV: Nerve to pectineus arising from the femoral nerve in right iliac fossa 45 mm above the inguinal ligament. 1 inguinal ligament, 2 femoral nerve, 3 nerve to pectineus, 4 pectineus, 5 iliacus, 6 psoas major.

posterior divisions. The nerve to pectineus arose from the anterior division of the femoral nerve (Fig. II). In a female cadaver, the left femoral nerve divided in the iliac fossa 38 mm above the inguinal ligament.

The lateral cutaneous nerve of thigh is normally a branch of the lumbar plexus. We found the origin of lateral cutaneous nerve of thigh from the femoral nerve in four lumbar plexuses (Fig. III).

Normally, nerve to pectineus arises from the femoral nerve below the inguinal ligament. We found the origin of the nerve to pectineus from the femoral nerve in iliac fossa in three lumbar plexuses. In one plexus, it arose 45 mm above the inguinal ligament in a male cadaver (Fig. IV); and in other male cadaver, it was a branch of anterior division of the right femoral nerve, which arose 25 mm above the inguinal ligament (Fig. II). We found all the fascicles of nerve to pectineus in the trunk of femoral nerve. In all the three lumbar plexuses neither obturator nor accessory obturator were supplying the pectineus.

We found splitting of the femoral nerve by psoas major muscle into larger medial and smaller lateral slips in three lumbar plexuses, the lateral slip fused with the medial slip to form main trunk of the

Fig.V: Left psoas major muscle splits femoral nerve. *1* femoral nerve, *2* obturator nerve, *3* psoas major, *4* iliacus

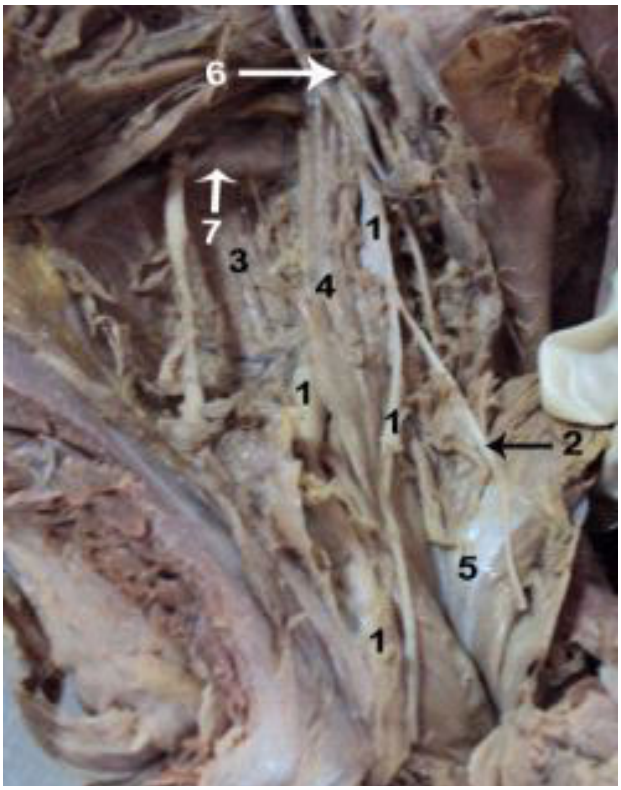

Fig.VI: Accessory slip of iliacus muscle splits the femoral nerve on right side. *1* femoral nerve, *2* nerve to psoas major arising from femoral nerve, *3* iliacus, *4* accessory slip of iliacus, *5* psoas major, *6* fifth lumbar transverse process and ilio-lumbar ligament, *7* iliac crest

femoral nerve 45 mm above the inguinal ligament in two plexuses and 40 mm above the inguinal ligament in one plexus (Fig. V). Further course and branching pattern of the femoral nerve were found to be normal. In all the three lumbar plexuses, neither obturator nerve nor accessory obturator nerve were supplying the pectineus muscle.

We found origin of accessory slip of the iliacus muscle from the transverse process of the fifth lumbar vertebra and iliolumbar ligament on the right side, connected with iliacus muscle by few muscle fibers, splitting the femoral nerve into two slips, in two lumbar plexuses (Fig. VI).

We did not find any significant sexual difference or lateralization in the formation and variation in branching pattern of the femoral nerve in iliac fossa.

Discussion:

The femoral nerve, the psoas major and iliacus muscles roofed over by the iliac~~us~~ fascia, form a tight fascial compartment, which accounts for femoral nerve lesions due to space-occupying processes in this area. In the cases of femoral nerve paralysis, neuropathy caused by iliac hematoma after anticoagulant treatment (Galzio et al, 1983) or vessel catheterization (Warfel et al, 1993), the existence of some variant muscles or variations in branching pattern of the femoral nerve may increase the chances of nerve compression.

To the best of our knowledge, abnormally long L2 root is not documented in literatures. We found abnormally long L2 root bilaterally in a male cadaver and knowledge of this variation in the formation of the femoral nerve may be important to anesthetists for successful lumbar plexus block.

Femoral nerve divided 3.2 cm above the mid-inguinal point in a male cadaver on both sides (Das &Vasudeva, 2007). We found division of femoral nerve in two plexuses at variable distance above the mid-inguinal point. Schultz et al (1991) has reported that lumbar plexus blockade have a lower incidence of complications than epidural blockade. The knowledge of early division of femoral nerve in iliac fossa is required to avoid incomplete femoral nerve block.

Lateral cutaneous nerve of thigh arose directly from the femoral nerve in 6 (10%) plexuses (Sim & Webb, 2004). Dias Filho et al (2003) reported origin of lateral cutaneous nerve of thigh from the femoral nerve inferior to the inguinal ligament in one case in their study. Uzmansel et al (2006) reported origin of accessory lateral cutaneous nerve of thigh from the

femoral nerve above the inguinal ligament in their case report. We found origin of lateral cutaneous nerve of thigh from the femoral nerve above the inguinal ligament in 4 plexuses. Origin of lateral cutaneous nerve of thigh from the femoral nerve may have impact on the clinical efficacy of lumbar plexus blockade, since femoral nerve blockade is likely to produce blockade in the area of distribution of lateral cutaneous nerve of thigh in these plexuses. Similarly, lateral cutaneous nerve of thigh blocks would produce femoral nerve blockade as described by Sharrock (1980). The impact of the presence of this variation on femoral and lateral cutaneous nerve of thigh blockade is yet to be investigated.

Femoral nerve supplies dorsal larger part of the pectineus muscle by one or two branches, arising in thigh, and ventral smaller part is supplied either by obturator nerve or accessory obturator nerve. One of the two branches from the femoral nerve may be given off in the abdomen (Paterson, 1891). Macalister (1889) described origin of nerve to pectineus from the femoral nerve within the abdomen with the medial cutaneous nerve of thigh. We found nerve to pectineus arose from the femoral nerve within the abdomen in three plexuses. In two plexuses, nerve to pectineus arose from the main trunk of the femoral nerve and in one plexus it arose from the anterior division of the femoral nerve. We found fascicles from ventral divisions of L2, L3 and L4 roots passing through the femoral nerve and supplying the pectineus muscle. In such cases the nerve to pectineus should be named as accessory femoral nerve.In all the three lumbar plexuses, neither obturator nerve nor accessory obturator nerve gave branches to the pectineus muscle..

Variant slips of the iliacus and psoas major muscles split the femoral nerve into two or three separate slips in 35.3% (Anloague & Huijbregts, 2009), 7% (Vazquez et al, 2007) and 2.2% (Spratt et al, 1996). Jakubowicz (1991) reported splitting of the femoral nerve by lateral fibers of psoas major muscle in 2.5% and by muscle fibers of iliacus in 2.5% in fetal lumbar plexus. Jelev et al (2005) reported accessory iliopsoas muscle splitting the left femoral nerve in a female cadaver. We found splitting of the femoral nerve into two slips by muscular slip of psoas major in three plexuses and by accessory iliacus slip in two plexuses. The femoral nerve slips fused with each other at variable distance above the inguinal ligament. Variant muscular slip of psoas major or accessory slips from iliacus which cause tension of the femoral nerve and, therefore, should be suspected in patients with referred pain to the hip and knee joints (Spratt et al, 1996). The accessory muscles may be seen as interesting findings in patients during retroperitoneal surgery in the lower lumbar region and should be kept in mind in the differential diagnosis on CT imaging of the iliopsoas compartment (Lenchik et al, 1994).

The anatomical variations of the femoral nerve can be explained on the embryological basis. Limbs develop in the form of buds of cellular undifferentiated mesoblast before the spinal nerves have any connection with them. Somatic branches of the nerves then stream out into the limb bud, passing into it below the ends of the myotomes and spreading out into a bundle of fibers at the proximal attachment of the limb. Later on, the nerves separate each into a pair of definite trunks, which are named dorsal and ventral, dividing round a central core of mesoblast and proceed to the dorsal and ventral surfaces of the limb bud respectively. While this process is going on, a secondary union takes place between parts of adjacent dorsal and ventral trunks. Dorsal trunks unite with other dorsal trunks, whereas the ventral trunks unite with ventral trunks, to form the nerves distributed ultimately to the surfaces and periphery of the limb (Cunningham, 1905). Variations in formation and branching pattern of the femoral nerve may occur due to abnormal union of dorsal and ventral trunks of the nerve during the fourth week of intrauterine development. These anatomical variations are usually concomitant with compensatory variations in adjacent nerves, and are due to the fibers of a given spinal nerve taking an abnormal course in the trunk of another nerve of distribution and effecting a communication with the proper nerve peripherally (Cunningham, 1905). In this way variations in the origin and distribution of nerve to pectineus from the femoral nerve and origin of lateral cutaneous nerve of thigh from the femoral nerve, and splitting of the femoral nerve by psoas major or accessory iliac muscle may be explained.

The knowledge of anatomical variations of the femoral nerve is essential for the surgeons to avoid iatrogenic injury to the femoral nerve, for the clinicians who are treating patients with meralgia paresthetica as lateral cutaneous nerve of thigh may arise from the femoral nerve, for the anesthetists to give successful block in femoral or lateral cutaneous nerve of thigh and for the anatomists to understand morphological importance of origin of nerve to pectineus in the abdomen.

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Research Article

Nutritional Status of Rural Pregnant Women

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Abstract:

Pregnancy is a crucial period of woman's life where socio-demographic factors affect her health as well as determine the health of future generation. A cross-sectional community based study was conducted in pregnant women in the field practice area of RCHTC, Hebbal. Variables considered for the study were: Age, religion, Socio-economics status, type of family & house, parity, spacing methods, utilization of health services, height, weight and Body Mass Index (BMI). Majority of pregnant woman had inadequate protien & calorie consumption during pregnancy; 23.93%, woman were having BMI<18.5; 66.67%, were anemic (Hb<11 gm%). The overall prevalence of anemia was found to be high among illiterate (98.2%), Hindu (92.31%) and moderately working woman (83.34%). Anemia was found to be more common whose age at first pregnancy was <20 years (57.28%), age at marriage <20 years (87.17%), in IInd trimester of pregnancy (62.83%) and in age group of 20-24 years (39.14%). Government hospital services were utilized by 78.63% but only 58.97% received iron & folic acid tablets and 70.94% had taken injection Tetanus Toxoid (TT).

Hence, effective intervention should be directed towards young pregnant women <20 years of age to improve maternal nutritional status, literacy level, and health education for utilization of health services.

Key Words: Maternal nutritional status; Body mass idex; Hemoglobin percentage.

Introduction:

Nutritional problems have serious public health significance impacting psychological, physical, developmental, behavioural and work performance of pregnant women. Iron deficiency is by far the commonest nutritional cause of anemia. It may be associated with folate deficiency, especially during pregnancy. Pregnant women form a large high-risk group requiring special care.

According to WHO, in developing countries, the prevalence of anemia among pregnant women is 56% (WHO, 1992). The prevalence of anemia in India is 60 -70% (Park, 2005). In India, anemia is the 2nd most common cause of maternal deaths accounting for 19% of total maternal deaths (Govt. of India, 2002).

Nutritional problem may be caused not only by deficiency of protein, calorie, iron, Vit C etc, but by other conditions like malaria, worm infestation, adverse environmental and socio-demographic factors. Association of nutritional problem with adverse maternal outcome such as puerperal sepsis, anti partum haemorrhage, post partum haemorrhage etc. are also responsible for low birth weight, premature birth, high perinatal mortality rate and decreased work capacity.

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In recent years, different Government programs like ICDS, RCH etc, have been introduced to improve the nutritional status of women. National Nutritional Anemia Prophylaxis Program (NNAPP) was initiated in 1970 with the aim to bring down prevalence of anemia to 25% (National Nutritional Policy, IX Plan). The daily dosage of elemental iron for prophylaxis and therapy has been increased to 100 mg & 200 mg respectively under Child Survival and Safe Motherhood Program (CSSM).

The present study was planned to find out the prevalence of anemia amongst pregnant women, the socio-demographic factors associated with anemia and utilization of health services by pregnant women.

Material and Methods:

The present cross-sectional community based study was conducted during June to November 2006 in the field practice area of Rural Community Health Training Center, Hebbal village which is under the Department of Community Medicine, M. R. Medical College Gulbarga. Rural Community Health Training Center, Hebbal has 15 villages under its jurisdiction. The house to house survey was conducted in all 15 villages. Pregnant women present at home at the time of survey were included in the study. The inclusion criteria for study subject were presence of signs and symptoms of pregnancy & willingness to participate in

the study. A total of 117 pregnant women were included in the study. They were clinically examined and interviewed using pre-structured, pre-tested proforma. The B.G Prasad classification was used for socio-economic status. Hemoglobin estimation was done by Salhi's method. Anemia was classified as per WHO criteria (Park, 2005). The height was measured up to nearest of 1cm and weight up to nearest of 0.5kg. The chi-square & Z-test were used.

Results:

The present study showed that maximum number of pregnant women were Hindus (88.80%), moderate worker (87.15 %) and were residing in kaccha house (92.30 %). Equal distribution of women was observed in nuclear type of family (48.70 %) and joint type of family (51.30%). Overall prevalence of anemia was 66.67%. Similar prevalence was found in nuclear (48.72%) & joint (51.28%) type of families. High prevalence of anemia was noted in Hindus (92.31%), moderate worker (83.34%) and 96.16% pregnant anemic women were residing in kachha house (Table I).

Table I: Distribution of women according to socio-demographic character & Anemia

Characteristic	Anemia n=78 (%)	Normal n=39 (%)	Total n=117 (%)	χ^2 value	p-value
Type of family					
Nuclear	38(48.72)	19(48.72)	57(48.70)	0.000	p>0.05
Joint	40(51.28)	20(51.28)	60(51.30)		
Type of house					
Kacha	75(96.16)	33(84.62)	108(92.30)	3.38	p>0.05
Pucca	03(03.84)	06(15.38)	09(7.70)		
Type of work					
Heavy	13(16.66)	02(05.13)	15(12.85)	2.15	p>0.05
Moderate	65(83.34)	37(94.87)	102(87.15)		
Religion					
Hindu	72(92.31)	32(82.05)	104(88.80)	2.77	p>0.05
Muslim	06(07.69)	07(17.95)	13(11.20)		

Maximum number of women (37.61 %) were in the age group of 20-24 years followed by 35.90 % in the age group of 25-29 years, 15.38 % in the age group of < 20 years and 11.11% in the age group of >30 years. Majority of women were married before 20 years of age (88.03 %) followed by 10.26 % and 1.71 % in age group 20-24 year and > 25 years respectively. Age of first pregnancy was < 20 years in 54.70% of women followed by 42. 74 % and 2.56 % in age groups of 20-24 years and > 25 years respectively at the time of pregnancy. Gastational age of 62.39% women at the time of study was below 28 weeks. The prevalence of anemia was maximum (39.74 %) in the age group 20-24 years followed by 32.06%, 15.48 % and 12.82 % in the age group 25-29 years, < 20 years and > 30 years respectively. High prevalence of anemia was observed in women who married (87.17%) and conceived (51.28%) before 20 years of age. During pregnancy, anemia was more common (62.83%) below 28 weeks of gestational age (Table II). 78.63% pregnant women were utilizing Govt. hospital health services. Choice for place of delivery was equal between hospital (49.57%) & home (50.43%). Overall, 58.97 % of pregnant women were consuming Iron and folic acid tablets and 70.94% women received injection Tetanus Toxoid (TT). Most of the pregnant women (82.91%) were not using spacing method. Majority of pregnant anemic women (76.92%) were utilizing Govt. hospital health services, 64.11% consuming Iron and folic acid tablets and 73.07 % women were receiving injection TT. Maximum number (97.44%) of pregnant anemic women were not using spacing methods. Choice for place of delivery among anemic pregnant women was hospital in 62.83% & home in 37.17% (Table III).

Table II: Distribution of women according to Age & Anemia

Charac-teristics	Anemia (%)	normal (%)	Total n=117 (%)	χ^2 value	p-value
Age (in Years)					
<20	12(15.48)	06(15.78)	18(15.38)	1.86	p>0.05
20-24	31(39.74)	13(32.84)	44(37.61)		
25-29	25(32.06)	17(43.68)	42(35.90)		
>30	10(12.82)	03(07.70)	13(11.11)		
Age at marriage					
<20	68(87.17)	35(89.75)	103(88.03)	1.02	p>0.05
20-24	08(10.26)	04(10.25)	12(10.26)		
≥25	02(02.57)	00(00.00)	02(01.71)		
Age at first Pregnancy					
<20	40(51.28)	24(61.54)	64(54.70)	2.25	p>0.05
20-24	35(44.87)	15(38.46)	50(42.74)		
≥25	03(3.85)	00(00.00)	03(02.56)		
Gestational Age					
<28 weeks	49(62.83)	24(61.54)	73(62.39)	2.25	p>0.05
≥28 weeks	29(37.17)	15(38.46)	44(37.61)		

Table IV shows that 76.92% were multigravida and 66.67% multipara followed by primigravida (23.08%) and primipara (33.33%). Prevalence of anemia was high in multi para (77.63%) & multigravida (79.48%)

Table III: Distribution of women according to Utilization of health services & Anemia.

Health Services	Anemia (n=78) (%)	Normal (n=39) (%)	Total (n=117) (%)	χ^2 value	p-value
Service utilization					
Govt. Hospital	60(76.92)	32(82.05)	92(78.63)	0.407	p>0.05
Private Hospital	18(23.08)	07(17.95)	25(21.37)		
Spacing method					
Yes	02(2.56)	18(46.15)	20(17.09)	38.002	p<0.001
No	76(97.44)	21(53.85)	97(82.91)		
Tab Iron & Folic Acid					
Yes	50(64.11)	19(48.71)	69(58.97)	2.54	p>0.05
No	28(35.89)	20(51.29)	48(41.03)		
Inj. TT					
Yes	57(73.07)	26(66.66)	83(70.94)	0.510	p>0.05
No	21(26.93)	13(33.34)	34(29.06)		
Preference for Place of Delivery					
Hospital	49(62.83)	09(23.07)	58(49.57)	16.43	p<0.001
Home	29(37.17)	30(76.93)	59(50.43)		

Table IV: Distribution of women according to Parity Gestational age and Anemia

	Anemia (n=78) (%)	Normal (n=39) (%)	Total (n=11) (%)	χ^2 value	p-value
Parity (Gravida)					
Primi	16(20.52)	11(28.21)	27(23.08)	0.87	p>0.05
Multi	62(79.48)	28(71.79)	90(76.92)		
All	78(66.67)	39(33.33)	117(100)		
Gestational age (>28 week of gestation)					
Primi	17(22.37)	18(62.07)	35(33.33)	14.89	p<0.001
Multi	59(77.63)	11(37.93)	70(66.67)		
All	76(72.38)	29(27.62)	105(100)		

Table V: Distribution of women according to BMI and Anemia.

BMI	Anemia n=78 (%)	Normal n=39 (%)	Total n=117 (%)	χ^2 value	p-value
<18.5	22(28.22)	6(15.38)	28(23.94)	3.04	p>0.05
18.5-25	52(66.66)	32(82.06)	84(71.79)		
>25	04(05.12)	01(2.56)	5(04.27)		

Table VI: Distribution of women according to consumption of Calories & Protein.

Nutrition	Anemia n=78 (%)	Normal n=39 (%)	Total n=117 (%)	χ^2 value	p-value
K Cal/day					
<2000	71(91.03)	23(58.97)	94(80.34)	16.911	p<0.001
≥2000	07(08.97)	16(41.03)	23(19.66)		
Protein					
<65	72(92.31)	34(87.18)	106(90.60)	0.803	p>0.05
≥65	06(07.69)	05(12.82)	11(09.40)		

followed by primi para (22.37%) & primigravida (20.52%). Overall 71.79% pregnant women were having BMI between 18.5 to 25 followed by 23.93 % women having BMI of <18.5 and 4.27 % had BMI >25. Prevalence of anemia was high (78.57%) among pregnant women having BMI<18.5 (Table V). Overall 80.34% & 90.60% pregnant women were not consuming adequate calories & protein respectively. None of them were consuming more than 2500 Kcl/ day. The prevalence of anemia was high among the women consuming proein <65 gm/day (92.31 %) and calories less than 2000 per day (91.03 %) as shown in Table VI. Prevalence of anemia was statistically not significant in the present study with relation to age of women, age at marriage, age at first child, weight, consumption of protein & calorie per day (Table VII).

Table VII: Showing various variables.

Variables	Anemia Mean ± SD	Normal Mean ± SD	Z-value	p-value
Age of womens	24.4 ±4.3	23.5 ±2.93	1.33	p>0.05
Age at marriage	18.4 ± 2.09	18.3 ±1.55	0.292	p>0.05
Age of 1st child	18 ±5.45	15.4 ±7.85	1.86	p>0.05
Gestational age	23.14 ±7.16	22.62 ±7.19	0.37	p>0.05
Weight	45.9 ±6.35	47 ±5.39	0.98	p>0.05
Calorie/day	1707.47 ±292.89	1703.33 ±276.97	0.07	p>0.05
Protein/day	55.48 ±93.91	99.87 ±152.36	1.67	p>0.05

Discussion:

High prevalence of anemia (66.67%) was observed in the current study where as Saxena et al (2000) and Gautam et al (2002) observed incidence of 36.1% and 96.5% respectively in their study. In the present study 94 (80.34%) & 106 (90.60%) pregnant women were taking < 2000kcal/day and protein < 65 gm/day respectively. Similar finding were reported by Sachar et al (1999) but Saxena et al (2000) reported that only 29.5% pregnant women were taking less calories & protein as compared to our study. 23.93% Pregnant women had BMI<18.5 due to many socio-economic reasons such as illiteracy and negligence of women in family. Similar observation was made by Saxena et al (2000).

Utilization of Health services were more in Govt. hospital but preference for place of delivery were equal between hospital and home. In the present study 58.97% of pregnant women received Iron & Folic acid tablets, where as 70.94% women received injection T.T. Corresponding figures are lower (31%

& 40 %) in the study by Chopra et al (1999).

High prevalence of anemia was noted in less than 28 weeks of gestational age of pregnant women (62.83%), the incidence is similar to that reported by Saxena et al (2000). The present study shows high prevalence of anemia in IInd trimester, illiterate pregnant women and who married (87.17%) and conceived (51.28%) before 20 years of age indicating pre-pregnancy status of women. The present study shows that p-value is more than 0.05 for all variable parameters. Therefore, it shows that prevalence of anemia was statistically not significant with relation to age of women, age at marriage, age at first child, weight, consumption of protein & calorie per day.

The above parameters indicate that there is need for community based strategy to improve maternal nutritional status, literacy level, utilization of Health Services and Health education with emphasis on delaying marriage and conception.

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Research Article

Conventional Septoplasty *verses* Endoscopic Septoplasty: A Comparative Study

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Abstract:

The study was carried out to compare the postoperative morbidity among patients of conventional and endoscopic septoplasty and to assess the efficacy and use of endoscopic septoplasty with other endoscopic surgeries. The present prospective study was conducted among 100 patients of deviated nasal septum, admitted in the department of Otorhinolaryngology, of Sawai Man Singh Medical College and hospital, Jaipur, Rajasthan. Patients were selected by simple random sampling procedure and were divided into group A and B, with 50 cases in each group. Group A underwent conventional septoplasty and group B underwent endoscopic septoplasty. Deviated nasal septum was commonly associated with inferior turbinate hypertrophy (75%) and concha bullosa (26%). Postoperatively, a significant relief from the symptoms of nasal obstruction (96%), nasal discharge (88%), headache (100%) and post nasal drip (67%) was observed in endoscopic septoplasty. Posterior deviations were best corrected by endoscopic septoplasty. Complication rate was higher in conventional septoplasty. The endoscopic approach to septoplasty facilitates accurate identification of the pathology. It facilitates realignment by limited and precise resection of the pathological areas.

Key Words: Endoscopic septoplasty, Conventional, Deviated nasal septum, Endoscopic sinus surgery (ESS)

Introduction:

Nasal obstruction is the most common complaint in rhinologic practice and a deviated nasal septum is the most common cause of nasal obstruction. The evaluation of septal deviation causing nasal obstruction depends heavily on physical examination and imaging (Dinis & Haider, 2002). Apart from nasal obstruction, a significantly deviated nasal septum has been implicated in epistaxis, sinusitis, obstructive sleep apnea and headaches attributable to contact points with structures of the lateral nasal wall (Pannu et al, 2009).

Numerous medical descriptions are available regarding the pathology and the treatment of the deviated nasal septum. However, none of these descriptions have highlighted a complete surgical management of this condition to improve the nasal airway. Each surgical procedure has its limitations and cannot deal with all the variants of the deformities of the nasal septum. An ideal surgical correction of the nasal septum should satisfy the following criteria : (a) should relieve the nasal obstruction; (b) should be conservative;(c) should not produce iatrogenic deformity; (d) should not compromise the osteomeatal complex and (e) must have the scope for a revision surgery, if required later.

The traditional surgeries of the nasal septum improve the nasal airway but do not fulfill the above mentioned criteria in most instances. The reasons being, poor visualization, relative inaccessibility, poor illumination, difficulty in evaluation of the exact pathology, need for nasal packing, unnecessary manipulation, resection and overexposure of the septal framework reducing the scope for a revision surgery, if required later.

The nasal endoscope allows precise preoperative identification of the septal pathology and associated lateral nasal wall abnormalities and helps in better planning of endoscope-aided septal surgery (Nayak et al, 1998). A directed endoscopic septoplasty approach is useful for treatment of isolated septal spurs in the absence of larger septal deviations. A directed approach results in limited dissection and faster postoperative healing. Septoplasty was first described by Cottle in 1947 as a treatment to correct nasal airway obstruction (Maran & Lund, 1990). Lanza et al (1991) described endoscopic techniques to correct septal deformities . Since that time surgeons have performed concomitent endoscopic septoplasties under varying situations not only to treat symptomatic nasal obstruction but also for improving surgical access to the middle meatus as an adjunct to ESS (Lanza et al,1993; Giles et al, 1994; Cantrell, 1997; Yanagisawa & Joe, 1997; Toffel, 1998; Hwang et al, 1999).

Early reports of endoscopic septoplasty describe several advantages associated with the technique. e.g. it makes easier for surgeons to see the tissue planes and it offers a better way to treat isolated

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septal spurs. Additionally, the endoscopic approach makes it possible for many people to simultaneously observe the procedure on a monitor, making the approach useful in a teaching hospital. Nasal endoscopy is a valuable tool for initial assessment of the relationship of the septum to the middle turbinates, which allows the surgeon to judge whether or not the position of the septum will limit access during ESS. Even in the absence of subjective nasal obstruction or gross septal deviation, septoplasty may be necessary to maximize access to the middle meatus during ESS, such as in the setting of a narrow nasal cavity with a prominent septal body. Nasal endoscopy is an excellent tool for outpatient surveillance following septoplasty during the initial postoperative healing period and beyond (Sautter & Smith, 2009).

Therefore, the present study was conducted to compare the postoperative morbidity among conventional and endoscopic septoplasty patients; to assess endoscopic septoplasty as the better surgical procedure in correcting high deviations and to assess the efficacy and use of endoscopic septoplasty with other endoscopic surgeries for sinonasal pathology like chronic dacryocystitis, concha bullosa and sinusitis.

Material and Methods:

One hundred patients of deviated nasal septum were selected by simple random sampling method, who were admitted in the department of Otorhinolaryngology, of Sawai Man Singh Medical College and Hospital, Jaipur, from July 2008 to September 2009. They were divided in to group A and B, with 50 cases in each group.

Group A underwent conventional septoplasty and group B underwent endoscopic septoplasty. Out of 50 endoscopic septoplasty, 20(40%) underwent this in conjunction with functional endoscopic sinus surgery and 7(14%) with endoscopic DCR (Fig.I).

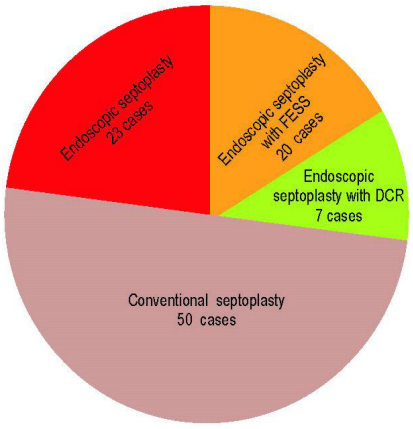
Endoscopic septoplasty 23 cases
Endoscopic septoplasty with FESS 20 cases
Endoscopic septoplasty with DCR 7 cases
Conventional septoplasty 50 cases

Fig. I: Type of surgery done among study subjects.

Inclusion criteria: Patients with nasal obstruction, nasal discharge, hyposmia, post nasal drip, facial pain and headache were included in the present study.

Exclusion criteria: Patients with allergic rhinitis and upper respiratory tract infection were excluded.

Ethical clearance was obtained from ethical committee of Sawai Man Singh medical college and hospital, Jaipur and informed consent was taken from each subject. A self prepared proforma was used to collect the patient's information which included patient's name , age , sex, occupation, present history, past history, complete examination of nose, anterior rhinoscopy, nasal endoscopy and radiological examination.

Statistical analysis was done using Statistical Package of Social Science (SPSS Version 15.0) and Z-test was applied.

Technique For Endoscopic Septoplasty:

The procedure was performed under local or general anaesthesia. The septum was injected with 1% xylocaine in 1: 20,000 epinephrine on the convex side of the most deviated part of the septum using 0° rigid 4 mm endoscope. Hemitransfixation was made. Incision was not extended from dorsum to the floor as in classical incision but was extended both superiorly and inferiorly just as needed to expose the most deviated part.

A submucoperichondrial flap was raised using a suction elevator under direct visualization with a endoscope, underlying bone was exposed and the most deviated part was removed .The flap was repositioned back after suction clearance and edges of the incision were just made to lie closely without the need to suture. The nasal cavity was packed with merocele (Nasal pack), which is sponge like & expands on getting wet and provides uniform pressure over all surfaces in contact. It also avoids mucosal abrasions while doing packing and removal of it.

The conventional approach involves headlight illumination and visualization with nasal speculum.

Results:

In the present study the male to female ratio for deviated nasal septum was 7:3. The most commonly affected subjects belonged to the 2nd and 3rd decade of life in both sexes (Table I).

Most prevalent complaint in the patients of deviated nasal septum among study subjects was nasal obstruction (74%) followed by anterior nasal discharge (41%), headache (20%), sneezing (15%), post nasal drip (8%), epiphora (7%), hyposma (3%), bleeding (3%) and snoring (3%).

Table I: Sample distribution of subjects according to age and gender.

Gender	10-20 Year	21-30 Year	31-40 Year	41-50 Year	Total
Male	25	27	10	08	70
Female	12	09	06	03	30
Total	37	36	11	11	100

Among the prevalance of lateral nasal wall pathology associated with deviated nasal septum,the commonest was Inferior turbinate hypertrophy (75%) followed by concha bullosa (26%), paradoxical middle turbinate (25%), Uncinate process abnormality (21%) and others (Table II).

Table III: Prevalance of lateral nasal wall pathology in association with deviated nasal septum among study subjects.

Lateral nasal wall pathology	No. of cases	Percentage
Concha bullosa	26	26%
Paradoxical middle turbinate	25	25%
Polypoidal middle turbinate	19	19%
Inferior turbinate hypertrophy	75	75%
Over pneumatised bulla	13	13%
Uncinate process abnormality	21	21%
Mucosal disease	21	21%

Postoperative follow up of the patients showed that 38% cases of group A and 96% of group B were relieved of nasal obstruction while headache was relieved in 54% of Group B and 50% of group A. There was no relief from hyposmia in group A while it was relieved in 10% of patients of group B. There was significant relief from nasal obstruction ($p<0.01$) and post nasal drip $p<0.05$) in group B patients (Table III). Objective assessment at last follow up among study subjects revealed that 13% of group A and 10% of group B cases had persistent anterior deviation; 23% of group A and 3% of Group B had persistent posterior deviation and 13% of group A had persistent spur. Persistent pathology of turbinates was found in 37% of group A and 20% of group B. There was significantly less persistence of posterior deviation, spur and synechia ($p<0.05$) in group B patients (Table IV).

Table III: Frequency of symptoms relieved Postoperatively among group A and group B subjects.

Symptoms relieved	Conventional -Septoplasty (Group A) N=50	Endoscopic-Septoplasty (Group B) N=50	Z-value	p- value
Nasal obstruction	19(38%)	48(96%)	5.95	0.0001(HS)
Headache	25(50%)	27(54%)	0.20	0.84(NS)
Nasal discharge	18(36%)	15(30%)	0.42	0.67(NS)
Hyposmia	0(0%)	5(10%)	1.82	0.06(NS)
Post nasal drip	9(18%)	20(40%)	2.20	0.02(S)

Table IV: Objective assessment at last follow up among study subjects.

Objective assessment at 3 months	Conventional-Septoplasty (Group A) N=50	Endoscopic-Septoplasty (Group B) N=50	Z-value	p-value
Anterior deviation	7(13%)	5(10%)	0.30	0.75(NS)
Posterior deviation	12(23%)	2(3%)	2.59	0.009(S)
Spur	7(13%)	0(0%)	2.35	0.01(S)
Synechia	10(20%)	0(0%)	3.0	0.002(S)
Persistent pathology of turbinates	19(37%)	10(20%)	1.76	0.07(NS)
Discharge in middle meatus	22(43%)	14(27%)	1.45	0.14(NS)

Disscussion:

With the introduction of endoscopes in other branches of surgery, there have been attempts at its utilization in septal surgery. Endoscopic septoplasty is an attractive alternative to traditional headlight approach for septoplasty.

Olphen (2008) described that Cottle in 1963 gave the concept of conventional septoplasty which is done in 6 phases: (a) gaining acess to the septum; (b) correction of pathology; (c) removing pathology; (d) shaping removed cartilage and bone; (e) reconstruction of the septum; (f) stabilizing the septum.

In the present study we found male to female ratio of septal deviation was 7:3 and the most common affected group were of younger age from 2nd & 3rd decades. This was in concordance with the study of Rao et al (2005).

Most common complaints of patients with septal deflections were nasal obstruction(74%), anterior nasal discharge(41%), headache(20%), sneezing (15%) and postnasal drip(8%).The frequency of complaints of nasal obstruction(75%) and nasal discharge(55%) were similar to the study of Gupta and Motwani (2005) but the headache was second major complaint in their study.

Nayak et al (2002) reported that several lateral nasal wall pathologies are associated with deviated septum, commonest and consistent being the inferior turbinate hypertrophy (75%) followed by concha bullosa, paradoxical middle turbinate, mucosal disease , overpneumatised bulla, polypoidal middle turbinate and uncinate process abnormality. In the present study we found almost similar incidence, commonest being, inferior turbinate hypertrophy (75%) followed by concha bullosa (26%), paradoxical middle turbinate (25%) and uncinate process abnormality (21%).

Endoscopic septoplasty is not primarily meant for relieving nasal obstruction but mostly it is performed to gain access to surgical site as in cases of FESS but has distinct advantages- in peadiatric cases, in revision surgeries and cases with previous septal perforation and also in cases with isolated septal spurs.Complex deformities need correction by conventional approach so also the caudal deflections. Out of the 50 cases selected for endoscopic correction in the present study, endoscopic septoplasty alone was performed in 23 cases, 20 cases in conjunction with FESS and 7 cases in conjunction with DCR. Cantrell (1997)and Hwang et al. (1999) have reported similar incidence.

Significantly higher rate of persistance of symptoms were found with conventional septoplasty as compared to endoscopic septoplasty in the present study and that of Nayak et al (2002).

In a study by Sindwani & Wright (2003) 54% patients with complaints of nasal obstruction and facial pain were cured and 38% showed improvement and 8% were not benefited. Harley et al. (2003) observed significant improvement in patients with nasal obstruction and headache in endoscopic group as compared to conventional group. In the present study more number of patients were relieved from these symptoms in endoscopic septoplasty as compared to conventional group (Table III). This is in aggrement with the observations of Gulati et al. (2009).

Park et al. (1998) observed that the synechiae were formed in significantly less number in patients of endoscopic septoplasty group as compared to conventional group; similar results were found in the present study. Complication rate in endoscopic septoplasty group was 3%, in the present study while complication rate was found to be 2.08% and 5% by Gupta et al. (2005) and Hwang et al. (1999) respectively.

In the study by Yoysem et al (1991), 88% patients needed septoplasty and 21.8% patients of Gaskin (1992) undergoing FESS underwent septal reconstruction, whereas in the present study endoscopic septoplasty was performed in conjunction with FESS in 20% cases.

The traditional approach to septoplasty involves headlight illumination, visualization through a nasal speculum, and surgical instruments that are typically disparate from that used during standard endoscopic procedures. These circumstances can be suboptimal when treating a narrow nose, approaching posterior deviation, or required frequent exchanges between headlight and endoscope. In addition impaired visualization may predispose to nasal mucosal trauma, which can compromise endoscopic visualization during sinus surgery.

Lastly, endoscopic septoplasty can also be considered an effective teaching tool. In fact, when viewed over a monitor, the procedure provides an excellent opportunity for recording and studying anatomy, pathology and surgical techniques in the training of Assisting Surgeons, graduate Specialists and Medical students.

Conclusion:

The endoscopic approach to septoplasty facilitates accurate identification of the pathology due to better illumination, improved accessibility to remote areas and magnification. It facilitates realignment by limited and precise resection of the pathological areas, by precise repair and strategically placed wedge resections. It effectively relieves contact areas and thus contact headache by allowing intraoperative assessment.

Endoscopic septoplasty is associated with significant reduction in patient's morbidity in both preoperative and postoperative period due to limited extent of flap dissection, not using killian nasal speculum which by pressure can cause preoperative discomfort, limited manipulation and resection of septal framework. However, the endoscope has its own limitations which include loss of binocular vision, need for frequent

cleaning of the tip of endoscope especially when there is more bleeding and lastly by endoscopic approach to septoplasty complex deformities with caudal deflections could not be corrected.

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Research Article

Parental Attitude and Knowledge Towards the Usage of Barrier Techniques by Pediatric Dentist

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Abstract:

To assess the parental attitude and knowledge towards the use of barrier techniques by the pediatric dentist, parents of 200 preschool pediatric patients were randomly selected and asked to fill the questionnaire related to the usage of barrier technique by the pediatric dentists.

Seventy five percent of the parents felt, that pediatric dentist should wear gloves and 35% wanted their pediatric dentist to wear mouth mask, 70% of parents thought that both pediatric dentist and the patients will be protected from the spread of the infection. Thirtyfive percent of them also wanted pediatric dentist to wear protective glasses during the treatment procedure. Eightyfive percent of them refused the treatment by pediatric dentists who were not wearing the gloves; 72% wanted the gloves to be changed for each patient. Fifty five percent of them thought that dental assistant also should wear gloves during treatment; only 55% of the parents were satisfied with the barrier techniques protocol of their pediatric dentist; Ninty percent of them thought that using gloves and mouth mask will scare the child. Quite high level of positive attitude and knowledge was seen in the present group of parents and they were not willing to take their child to the pediatric dentist who didn't follow the proper barrier technique.

Key Words: Gloves, Pediatric dentist, Attitude, Infection.

Introduction:

Dental practice has changed its attitude considerably towards the cross infection measures. A decade ago wearing gloves was considered necessary for the selected procedure, but with the increase in the incidence of the spreadable diseases like AIDS, hepatitis, SARS, H1N1, herpes simplex etc, dental community has changed it's attitude towards cross contamination measures (Burke et al, 1992). Barrier techniques as mouth mask, gloves, protective eyewear, and protective clothing were recommended to protect both the operator and the patient from cross-infection during routine examination, as well as during dental treatment procedures, apart from providing patient with the sense of security and trust towards the dentist (Goldmann, 1991; Larson, 1995; Burke et al, 1991; Al-Moherat et al, 2008). Many authorities (Centers for Disease Control,1993; British Dental Association, 1987; Rustage et al, 1987; Olnsted , 1978; Crawford , 1985; Burke et al,1991) have recommended the comprehensive guidelines for the cross infection control and usage of gloves as one of the measures to reduce the risk of infection, because hands are the major source of infection especially the nail folds (Burke et al, 1993; Allen & Organ, 1982; Al-Moherat et al, 2008). Mousa et al (1997), Samaranayake & McDonald (1990), Porter et al (1993) and Bowden et al (1989) have found that high level of awareness existed in the patients towards the usage of barrier techniques. This high level of awareness in the patients have improved the behavior of dentist towards the usage of barrier techniques (Burke et al,1991; Chenoweth et al, 1990). With wide spread increase in infectious diseases all over the world, it becomes a compulsion to re-evaluate the knowledge and attitude of the pediatric dentist as well as the parents in respect to infection control protocol. Even though, there are number of studies done with the intention of assessing dentists knowledge towards barrier technique, very few studies have reported parental attitude towards infection control protocol. Besides, these studies have mainly concentrated on the usage of gloves and none reported the knowledge related to other barrier techniques like mask, protective glasses etc. The present study aimed to assess the attitude and knowledge of the preschool children's parents towards the usage of different barrier techniques by the pediatric dentist.

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Materials and Methods:

Two hundred parents of the preschool pediatric patients were randomly selected utilizing simple randomization technique for the study. Out of 200 parents, 100 were males and 100 were females. The subject's age ranged from 30-40 years, with the mean

age of 35±5 yrs. A questionnaire of 12 questions related to parent's attitude and knowledge towards the usage of barrier techniques as mouth mask, gloves, protective eyewear, and protective clothing by pediatric dentist was designed by the expert panel, which included experienced pediatric dentists. The questions like do you think that pediatric dentist should wear gloves while treating patients & would you attend a Pediatric dentist who didn't wear gloves, evaluated the attitude of the parents towards the infection control. Similarly questions like, are gloves worn to protect the Pediatric dentist or the patient and who will be protected from infection by wearing mouth mask, were framed to judge the knowledge of the parents. Questions were framed in both English and the native language (Hindi). Ethical approval was obtained by the ethical committee. Parents were informed regarding the purpose of the study and the questionnaires were distributed. Proper instruction pertaining to the filling of questionnaire utilizing the multiple choice question was provided. They were asked to fill them in the department itself. In case of the uneducated parents, one of the authors explained the question in the native language and the answer provided were ticked by either of the authors. Data was collected and statistically analysed.

Results:

Out of 200 parents, 50% of the parents were well educated and most of them came from high to medium level of socioeconomic status.

Seventyfive percent of the subjects wanted their pediatric dentist to wear the gloves, 35% of subjects wanted pediatric dentist to wear the mouth mask and an equal percentage of parents believed that pediatric dentist should wear protective glasses. Majority of subjects believed that wearing mouth mask and gloves will protect both pediatric dentist and patients from infection. Fifty percent of the parents thought that dental assistant should also wear gloves (Fig. V). Eighty percent of the subjects refused to take their child to the pediatric dentist who didn't wear gloves (Fig. III).

When the purpose of wearing gloves was considered, 45 % of parents thought that wearing gloves will prevent transmission of infection from patient to pediatric dentist (Fig.VI). Fifty five percent of them were satisfied with the type of barrier techniques used by the pediatric dentist (Fig. VIII). Ninty percent of the parents thought that child will be scared by seeing a gloved hand and masked face of the pediatric dentist (Fig. VII).

The knowledge and attitude of the parents regarding usage of different barrier technique by the pediatric dentist is illustrated in the (Fig. VII).

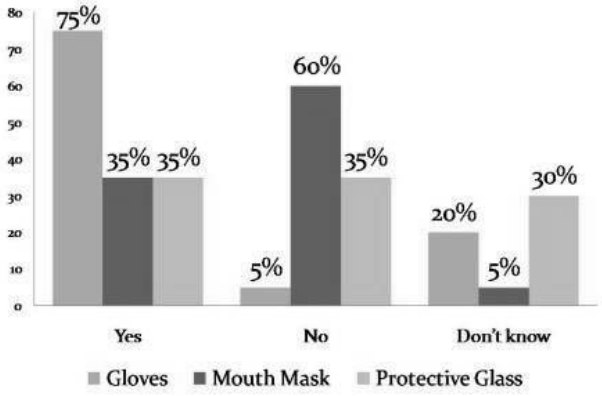

Fig. I: Parent's attitude towards the usage of protective barriers by pediatric dentist

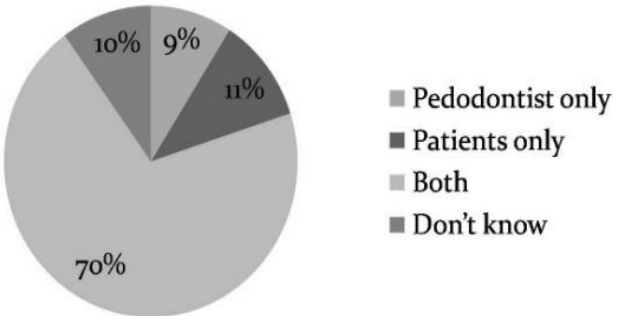

Fig. II: Parent's opinion on whether gloves are worn to protect pediatric dentist or patient

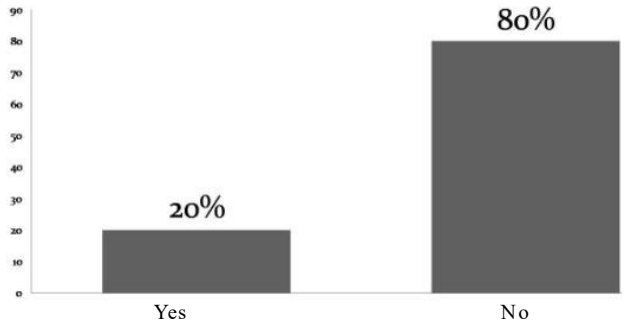

Fig. III: Parent's opinion on whether they will go to pediatric dentist who doesn't wear gloves.

Discussion:

Drastic changes are noticed in dental practice since the introduction of the infectious diseases like AIDS, hepatitis, different kind of flues in different parts of world. The media coverage on this topic has been extensive and has contributed substantially in increasing

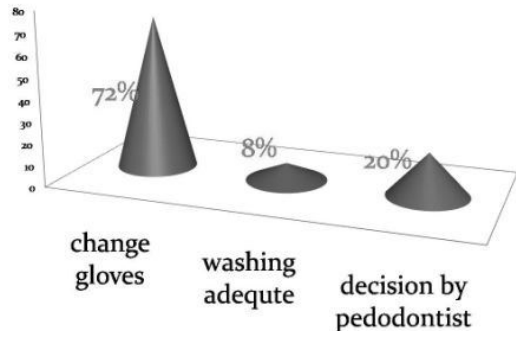

Fig. IV: Parent's opinion on whether a pediatric dentist should change gloves between patients or washing is sufficient

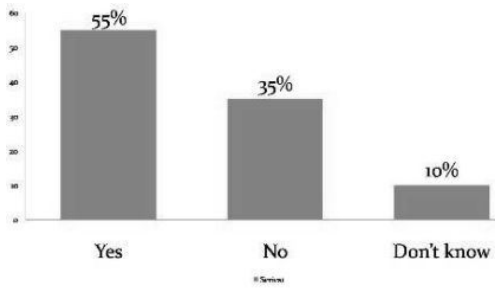

Fig. V: Parent's opinion on whether dental assistant should wear gloves or not.

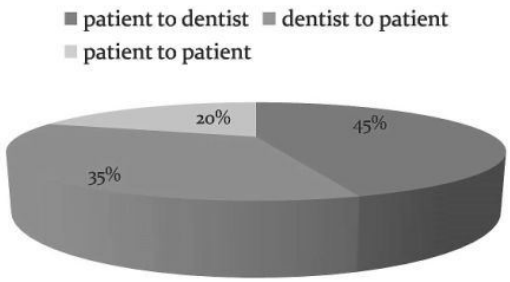

Fig. VI: Knowledge regarding the purpose of wearing gloves

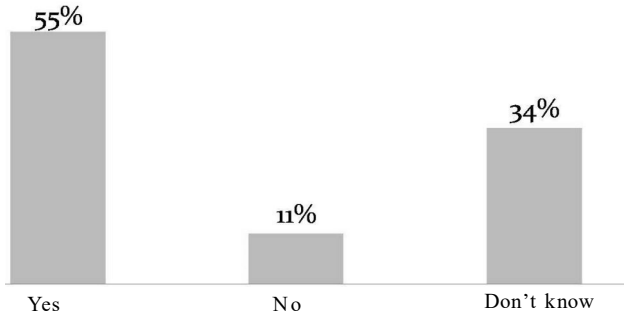

Fig. VII: Parent's opinion on whether they are satisfied with barrier technique used by the pediatric dentist.

the awareness of public in this regard (Thomson et al, 1997). The present study was undertaken with the aim to assess parental attitude towards usage of barrier technique by the pediatric dentist. Preschool children lack the ability of abstract concept and abstract reasoning and the decision related to them, therefore, should be taken by the parents. Thus, the parent's opinion in relation to cross infection control procedure used by the pediatric dentist carries great importance.

Majority of the parents felt that pediatric dentist should wear gloves routinely during dental treatment, indicating the positive attitude of parents towards the use of gloves. The results were in accordance to the reports of Al-Moherat et al (2008) who did a study to assess the knowledge of glove usage by the parents as well as the children. Similar results were also reported by Burke et al (1991); Mousa et al (1997); Bowden et al (1989) and Kerans et al (1998), reiterating the high level of public awareness. In response to this, several pediatric dentists have changed some aspects of the infection control procedures. A survey by Chenoweth et al (1990) reported that 85.9% of the pediatric dentist used gloves routinely.

Comparatively, higher number of the parents didn't like to go to a pediatric dentist who does not wear gloves; the percentage of the present study was low as compared to the results of Kearns & Burke (1998) and Al-Moherat et al (2008). Contrasting results have been reported by the Burke et al (1991) and Otuyemi et al (2001) who reported that 51.51 and 34% of patients respectively attended the dentist even if he was not wearing gloves. Most of the parents opined that even though wearing gloves and mask may scare the child patient in the first visit but during the subsequent visit the child might get used to it. Similar results were reported by Siegel et al (1989).Nevertheless, the parents thought that this should not hinder the barrier technique used by the pediatric dentist and there was no need to compromise the infection control measures. Further, a study on evaluation of changes in children's dental fear has reported that framework of conditioning and gradual exposure in children will prevent dental fear (Klaassen et al, 2008).

The aim behind wearing gloves is to protect the dentist and patients from infection and to avoid transmission of disease from patient to patient. In the present study, the overwhelming majority of parents considered gloves to be worn for protection of both the dentist and patients, but only 45% felt that wearing gloves will prevent transmission of the infection from patients to dentist. Even though parents had high level of awareness, but the knowledge seemed to be

superficial. In contrast, Bowden et al (1989) reported that will 31% percent patients believed that glove wearing protect dentist only; Otuyiemi et al (2001) had also reported similar results.

In the present study, high level of awareness was again proved by the fact that only 8 percent of the parents didn't mind if their pediatric dentist used the same gloves after washing in between the patient. But this percentage was quite high in comparison to the reports of Kearns et al (1998) who reported that only 2.5 percent of patients felt that washing the gloved hands will be enough. Such favourable results were reported in the earlier studies by Crawford, 1985; Otuyemi et al, 2001; Klaassen et al, 2008. Wearing gloves by the dental personnel has been advised as an essential element of cross-infection control in dental surgery (Rustage et al, 1987; Olnsted, 1978;. Crawford, 1985).

A Study showed that 55 percent of parents considered that wearing gloves was necessary for the dental assistant, owing to the fact that dental assistants will be assisting the pediatric dentist during dental treatment and their hands were considered to be a major source of infection (Burke et al, 1993).

Only 35 percent of parents in the present study felt that pediatric dentist should wear mouth mask, which was less than the percentage of parents who wanted the pediatric dentist to wear gloves and the reason why it has to be worn. In contrast, rather a high percentage (55%) was reported by Mousa et al (1997). Chenoweth (1990) reported that around 77 percent of the patient preferred their dentist to wear mouth mask. They felt that the purpose behind wearing mask was to protect both pediatric dentist and the child, but routine use of mask by pediatric dentist was reported by 45.6% in their study, which was undertaken with the aim to evaluate the barrier technique used by the pediatric dentist.

Craig & Quayle (1985)in their study mentioned that the mask worn for more than 20 minutes will potentially harbour micro organisms and that it is better to work unmasked than to wear the same mask for longer duration. Nearly 55 percent of patients were satisfied with the barrier techniques followed by their pediatric dentist.

Wearing a protective glasses by the pediatric dentist was considered unnecessary by 35 percent of the parents in the present study; in contrast, Chenoweth (1990) reported rather a high percentage of pediatric dentists who wore protective glasses routinely. However, Shulman & Brehm (2001) observed that 54.1 percent of patients preferred their dentist to wear protective glasses when doing the treatment. Askarian & Assadian (2009) conducted a study on the knowledge, attitude and practice of the infection control in the Iranian dentist and dental students. They reported that the subjects had high level of knowledge attitude but they didn't adhere strictly to the infection control guidelines.

Conclusion:

A high level of infection control awareness was seen in this particular group of the parents. They preferred not to visit pediatric dentist, who didn't wear gloves. Only 55% of the subjects were satisfied with the barrier technique used by the pediatric dentist.

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Research Article

Effect of Cola on Surface Microhardness and Marginal Integrity of Resin Modified Glass Ionomer and Compomer Restoration – An *in vitro* Study

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Abstract:

This study was carried out to evaluate the surface microhardness and marginal integrity of a resin modified glass ionomer and a compomer after immersing them in a cola soft drink for variable periods of time. The study was conducted in two parts. Forty two standard class V cavities were prepared on extracted human premolars, restored with Dyract AP and Fuji II LC and evaluated for marginal integrity. Forty two circular discs (CDs) were prepared with Dyract AP and Fuji II LC to test microhardness. These specimens were immersed in a cola drink under low, medium and high immersion regimes. Marginal integrity was analyzed using stereomicroscope and surface microhardness was evaluated on the circular discs using a microhardness tester. Statistical analysis revealed that the marginal integrity was least affected in low and medium immersion regimes and highly affected under high immersion regime. Surface microhardness was least affected in low immersion regime, while, medium and high immersion regimes showed appreciable softening of both restorative materials evaluated.

Key Words: Resin modified glass ionomer, polyacid modified resin composite, cola, low pH.

Introduction:

Glass ionomer cements are becoming increasingly popular in pediatric dentistry. Glass ionomer cements were first introduced to the dental profession by Wilson & Kent in 1972 (Wilson, 1991). As a restorative material, their sensitivity to moisture, low mechanical strength and wear resistance make them less durable (Hse et al,1999). Rapid developments in the field of hybrid resinionomer restorative materials led to the development of light cured glass ionomers and polyacid modified resin composite. The light cured glass ionomers were developed chiefly to overcome the problems of moisture sensitivity and low early mechanical strength, at the same time maintaining their clinical advantages. Their command set facility and fluoride releasing properties have made them very popular.

Compomers, as the name implies, combine the characteristics of both composites and glass ionomers into a single component. But it shows minimal glass ionomer reaction and so a more preferred nomenclature for this material is "polyacid modified resin composites" (McLean et al, 1994). The rapid acceptance of these new resinionomer hybrid restorative materials by the dental profession was largely due to their ease of use (Hse et al, 1999).

Over the last few decades, the prevalence of erosion seems to have increased presumably due to increased consumption of soft drinks and fruit juices (Nunn, 1996). Marketing of soft drinks traditionally has been directed at the younger generation by associating these beverages with peer group acceptability (Shaw & Smitha, 1999).

More recently, these drinks have also been promoted as healthy and linked to high profile sportsmen and celebrities. Erosion is linked to high intake, frequency and method of consumption of acidic beverages (Kelleher & Bishop, 1999). Excessive contact of the tooth structure with acidic food leads to loss of dental hard tissues. It can be assumed that restorative materials are also subjected to low pH values in the oral cavity by erosive attacks, leading to a degradation of the surface integrity (Kelleher & Bishop, 1999; Attin et al, 1997).

The glass component of these materials can react at acidic pH level (Zero, 1996). The presence of acids may cause surface changes of these materials (Zero, 1996) as phosphoric acid is a common constituent of cola soft drinks (Kula et al, 1996; Rytömaa et al, 1988).

It is also of great interest to obtain information on the behavior of these restorative materials under a range of pH conditions. There is no literature reporting on the effects of acidic pH due to cola consumption on the marginal integrity and surface microhardness of these newer hybrid glass ionomers. Considering the above aspects the present study was designed and carried out to evaluate the effect of Cola on a) marginal

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integrity & b) susface microhardness of Dyract AP (Polyacid modified composite resin) and Fuji II L.C (resin modified glass ionomer restorative material).

Materials and Methods: The present study was conducted in two phases:

Phase I: Microleakage study on standard class V cavities prepared in 42 extracted sound human premolars and restored with Dyract AP and Fuji II L.C restorative materials.

Phase II: Surface microhardness study on standard 42 circular discs(CDs) prepared with Dyract AP and Fuji II L.C restorative materials.

Phase I :

a) Preparation of samples for microleakage study:

Forty two extracted non-caries human premolars were stored at room temperature in 0.02% thymol solution. Teeth were scaled, cleaned with water and pumice in a rubber prophylaxis cup at low speed and examined for the presence of any craze lines and cracks that could have influenced dye penetration (Bouschlicher et al, 1996).

Buccal Class V cavities were prepared using a straight fissure diamond bur in high speed air-rotor handpiece under water spray with the dimensions of prepared cavity being at least 3 x 2mm and depth of 2mm (Bouschlicher et al, 1996). Cavities were placed 1mm coronal to Cemento Enamel Junction (CEJ; Hall et al, 1993). Forty two teeth thus prepared were divided into two equal groups for Dyract AP and restoration and for Fuji II LC restoration.

For Dyract AP restorations, the cavity walls were etched with 36% phosphoric acid gel, treated with Prime & Bond 2.1; single compound was syringed into the cavity and light cured for 40 seconds. For Fuji II LC restoration, the cavity walls were conditioned with GC dentin conditioner (20% polyacrylic acid) for 10 seconds and following the manufacturers instructions the powder/liquid proportion were mixed and placed in the cavity and light cured. Immediately after light curing, both groups of restorations were finished using water cooled fluted carbide bur and polished using abrasive disc (Sof-flex), which were used wet. After finishing, the restoration were lightly air dried, unfilled resin applied and cured.

Forty two restored teeth were kept in 100% humidity at 37^0 C for 24 hours. On removal of the restored teeth from the humidity chamber after 24 hours, they were divided into 3 groups. All specimens were maintained in deionized water until the time of testing.

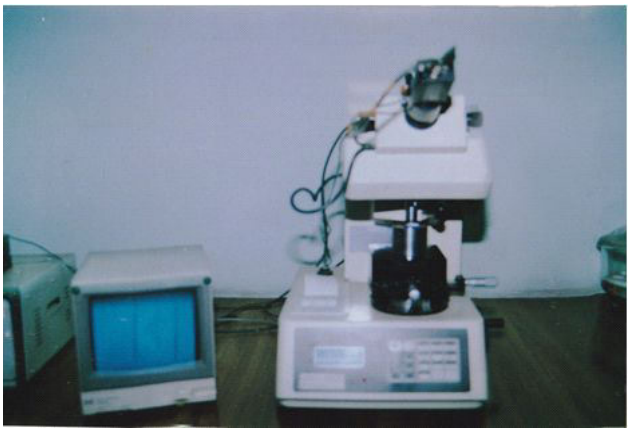


Fig. I: Microhardness testing unit.

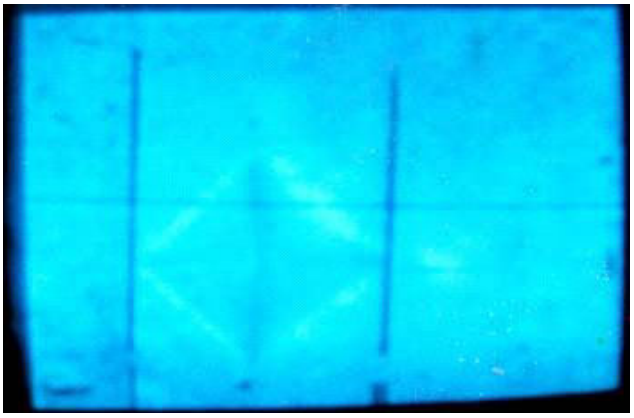


Fig. II: View of indentation.

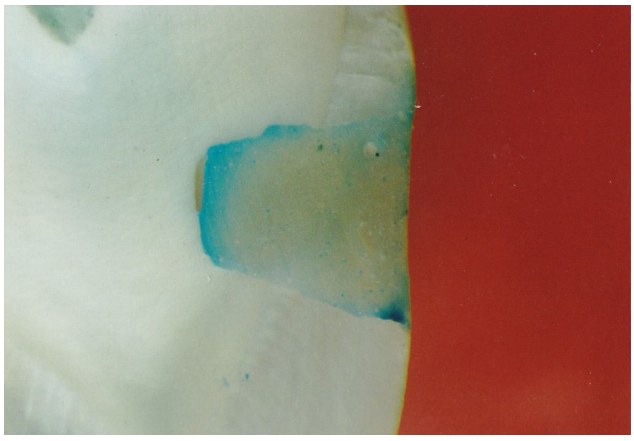


Fig.III: High immersion group of Fuji II L.C—Score 3.

b) Immersion Regimes:

Six air tight plastic containers were taken; seven restorations of each material from individual immersion groups were placed in one plastic container and carefully labeled. Each of the plastic containers was filled with 25 ml Cola solution (Coke-Cola) for 5 minutes (Maupomé et al, 1998). Fresh Cola was used for each immersion. Low immersion regime was

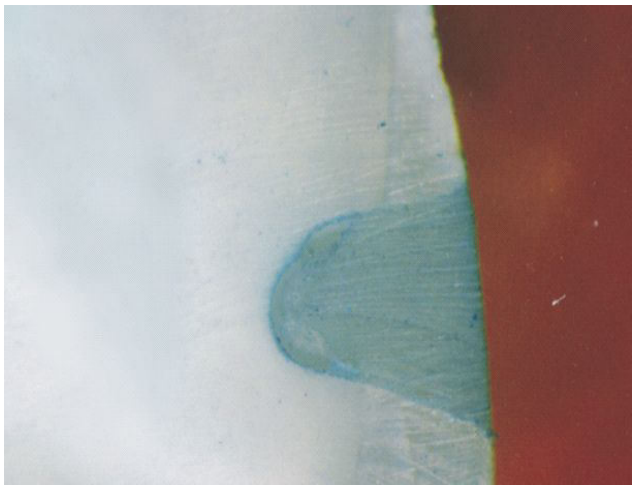


Fig. IV: High immersion group of Dyract AP—Score 3.

subjected to one immersion per day & medium regime to five immersions per day evenly distributed over 12 hours period. The high immersion regimes were subjected to ten immersions per day evenly distributed over 12 hours period, each day for seven days (Staninec & Holt, 1988).

Before and after each immersion in the Cola, the restorations were copiously rinsed in 0.1 M phosphate buffered saline (PBS) with pH 7.2. When not exposed to the drink, the restorations were stored in deionized water at room temperature (Maupomé et al, 1998).

At the end of test duration, the apices of the tooth were sealed with sticky wax and all tooth surfaces except a 1mm wide zone around the margin of each restoration were painted with nail varnish.

The teeth were then immersed for 4 hours in 10% solutions of methylene blue dye (Brackett et al, 1995; Ferrari et al, 1996), rinsed, dried and invested in clear resin. Each tooth was sectioned bucco-lingually through the center of the restoration with the help of a low speed water cooled diamond disc. The specimens thus obtained were examined under stereomicroscope to evaluate the microleakage and dye penetration scores. The scoring criteria was similar to that used by Staninec & Holt (1988).

Phase II:

a) Preparation of samples for microhardness: Forty two circular discs were prepared with Dyract AP and Fuji II LC restorative materials using brass mould having inner diameter of 6.5 x 2 mm thickness.

Dyract AP material available in single component was syringed into the brass moulds. For Fuji II LC following manufacturers instructions the powder/liquid proportions were mixed and placed in the brass mould and cured and were covered with matrix strips on either side.

For both Dyract AP and Fuji II LC circular discs, no finishing or polishing procedure was required because the surfaces were cured against a matrix (Frazier et al, 1998). Then on each side of circular discs unfilled resin was applied and light cured (Ferrari & Davidson, 1996).

All the circular discs were kept in 100% humidity at 37^0 C for 24 hours. On removal of the pellets from the humidity after 24 hours, the pellets were divided into three equal groups and each pellet was assigned a test tube and carefully labeled containing deionized water until the time of testing.

b) Base line study of microhardness:

The circular discs were stabilized on plastic plate with the help of adhesive tape and placed on the test base of the SHIMADZU HMV- 2000 microhardness tester. The testing parameter was 100 gm for 15 seconds (Cattani-Lorente et al, 1999; Gladys et al, 1997; Attin et al, 1996). The square based diamond pyramidal indentation so formed was measured on display monitor and measuring unit displayed the Vickers hardness numbers (VHN).

The second indentation on the same specimen was done at least 100 mm apart from the first indentation and procedure was repeated. If the 1^{st} and 2^{nd} indentation differed by more than 5 units, a 3^{rd} indentation was taken. Otherwise, 1^{st} and 2^{nd} indentation was averaged as VHN for those individual circular discs .

All the circular discs were subjected to immersion regimes similar to the microleakage study.

c) Final microhardness testing:

After the end of test duration, the pellets were re-tested under microhardness testing machine in a similar way as baseline study and these values was noted on the table as final VHN value of each pellet. The values obtained as base line and final VHN for each pellet were subjected to statistical analysis.

Results:

The mean and standard deviation were calculated for the comparison of microleakage score of Dyract AP and Fuji II LC (Table I). In low immersion regime, both Dyract AP and Fuji II LC showed zero microleakage score and in medium immersion regimes one sample of Dyract AP group showed microleakage

score of three (0.43 ± 1.13) while two samples of Fuji II LC group showed micrleakage score of one (0.29 ± 0.49). In high immersion regime all samples of both Dyract AP and Fuji II LC showed microleakage score of 3 (mean 3.0; Fig. III & IV).

Baseline and final values of surface microhardness for Dyract.

Table No. I: Microleakage Score of Dyract AP and Fuji Ii L.C

Materials	Immersion	Microleakage Score				Mean Score ± S.D.
		0	1	2	3	
Dyract AP	Low	7	-	-	-	0.0
	Medium	6	-	-	1	0.43 ± 1.13
	High	-	-	-	7	3.0
Fuji II L.C	Low	7	-	-	-	0.0
	Medium	5	2	-	-	0.29 ± 0.49
	High	-	-	-	7	3.0

Table No. II: Comparison of Surface Microhardness between Baseline and Final values expressed in VHN.

Material	Immersion Group	Base Line		Final		Differ-ence *	% redu-ction	p-value **
		Mean	SD	Mean	SD			
Dyract AP	Low	24.64	2.50	23.32	2.39	-1.32	5.4%	NS
	Medium	27.72	2.34	21.91	5.96	-5.81	20.9%	p < 0.01
	High	29.50	4.74	22.54	2.40	-6.96	23.6%	p < 0.01
Fuji II L.C	Low	51.67	7.67	46.19	9.93	-5.48	10.6%	NS
	Medium	41.97	10.78	26.21	4.53	-15.76	37.5%	p<0.01
	High	53.72	9.13	33.13	2.59	-20.59	38.3%	p < 0.01

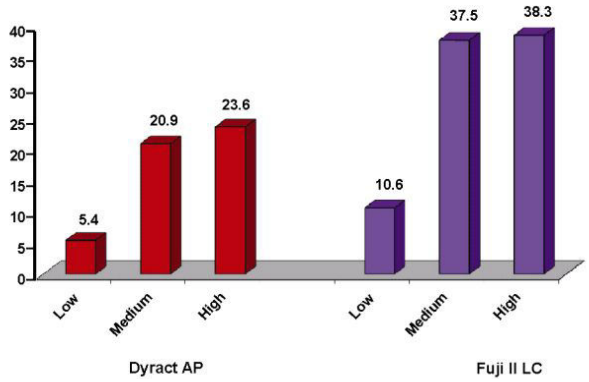
* -ve sign indicates reduction in surface microhardness
** Mann-Whitney U-test.

AP and Fuji II under low, medium and high immersion were compared. In the low immersion regime both the evaluated materials showed no significant reduction in microhardness, while Dyract AP showed 20.9% and 23.6% reduction in microhardness under medium and high immersion regimes respectively, which was statistically significant (p<0.01). Similarly, Fuji II LC showed 37.5% and 38.3% reduction in microhardness under medium and high immersion regimes respectively (Fig.V) which was statistically significant (p<0.01). Comparing Dyract AP & Fuji II LC groups, statistically significant difference was observed between the two in all the three regimes. There was also statistically significant difference (p<0.01) between low and medium as well as low and high immersion regimes. However, there was no statistically significant difference between the medium and high immersion regimes.

Table III: Comparison of changes in surface of microhardness between various immersion groups.

Immersion		Difference between base line and final VHN				
		Dyract AP		Fuji II LC		Difference between material in each immersion
		Mean Diff.	% Reduc-tion	Mean Diff.	% Reduc-tion	Significance of difference
Low (I)		-1.32	5.4%	-5.48	10.6%	p<0.01
Medium (II)		-5.81	20.9%	-15.76	37.5%	p<0.01
High (III)		-6.96	23.6%	-20.59	38.3%	p<0.01
Difference between immersion	I – II	p < 0.01		p < 0.01		
	I – III	p < 0.01		p < 0.01		
	II – III	NS		NS		

Fig. V : Percentage reduction of surface microbhardness in dyract AP and Fuji II L.C.



Discussion:

The role of acid in causing dental erosion, where there is irreversible loss of dental hard tissue by a chemical process without the involvement of micro-organisms has long been established. The acids maybe derived from intrinsic or extrinsic sources. In the oral environment, both dissolution of elements and erosion of the non soluble components of the material occur on exposure to acidic media.

Steffen (1996) reported that it was the chemicals in Cola soft drink that affected the integrity of the enamel surface. Though enamel being the hardest material reported, is not spared of the devastating effects of Cola. It is no matter of surprise when tooth coloured materials with mechanical properties much inferior than enamel, exhibit higher vulnerability to the effects of Cola. The observed surface damage was attributed to softening or removal of portion of the set matrix by chemical in oral environment. Thus, interactions among substances in

oral cavity have a negative impact on the durability of dental restorations (Wu et al, 1984).

The erosive potential of soft drinks has been reported both *in vivo* and *in vitro*. However, many erosion studies have employed extremely long intervals of immersion in acidic solutions (Steffen, 1996; Rugg-Gunn et al, 1998; Sorvari et al, 1994; Meurman et al, 1991; Grando et al, 1996). There are number of possible limitations in above mentioned studies, if we attempt to use them as proxies of a real life situation. Principally these do not accurately depict the actual impact of the frequency, prolonged and continuous exposure to Cola (Maupomé et al, 1998; Steffen, 1996; Watts et al, 1995; Chadwick et al, 1990). Accordingly, a more realistic consumption pattern replicated under experimental conditions would be helpful in determining the actual impact of soft drinks by resembling real exposure. In the present study different immersion regimes were followed (Maupomé, 1998; Maupome et al, 1999).

The results of dye penetration scores were least in low and medium immersion group for Dyract AP and Fuji II L.C restorative materials. While highest dye penetration scores in high immersion group for both Dyract AP and Fuji II L.C restorative materials were observed.

Steffen (1996) stated that the chemical in Cola soft drinks affected the integrity of the enamel surface; his study concluded that Cola removed much of the sealant along with the enamel. It is quite probable that the higher microleakage scores seen in the present study could be due to much of the restorative materials being removed along with the enamel by the high immersion Cola regimes.

Surface deterioration of Dyract AP and Fuji II LC restorative materials were placed in a brass mould which ensured standardization of the shape and size of each circular discs (Kudalkar & Damle, 1997). The setting material were covered with matrix strips on either side to avoid early moisture contamination and were held under constant hand pressure using glass slab on either side in order to obtain polished flattened surface. This polished flattened surface was essential to prevent distorted indentation for hardness measurement on any material (Kelleher & Bishop, 1999; Maupomé et al, 1998; Cattani-Lorente et al, 1999; Attin et al, 1996).

Before subjecting the pellets for cola immersion, base line VHN value for each circular disc was evaluated using surface microhardness tester (Shimadzu HMV-2000, Germany). Vickers hardness measurements covered the requirements of the standard test method of materials as defined by American society for testing materials (Attin et al, 1996).

The microhardness tester was standardized prior to indentation on each circular disc. The testing parameter of 100 gm of force for 15 seconds initiated no cracks on the surface of the material, thereby, providing a size of indentation that allowed measurement of surface hardness of these material. Similar method was also used by Attin et al (1996); Gladys et al (1997) and Cattani-Lorente et al (1999).

Attin et al (1996) reported that Dyract AP restorative material had higher surface microhardness than did Fuji II LC restorative material. In our study, base line surface microhardness was at par with the values reported by Gladys et al (1997). Bothe the study showed surface microhardness of Fuji II LC has higher VNH than Dyract AP restorative material.

The results of this study showed generalized reduction in surface microhardness in all the three immersion groups of Dyract AP and Fuji II LC restorative materials. de Gee et al (1996) reported that although in Fuji II LC the interpenetrating matrices of cross-linked polyalkanoate and poly-HEMA are not chemically integrated, but merely entangled with one another, the presence of the resin appears to be sufficient to provide protection against an environment with pH of 5.0. They reported that in this category of materials susceptibility to acids becomes noticeable at low pH values (pH 4).

Studies on polyacid modified resin composites by Attin et al (1998) and Watts et al (1995) proved that these materials are surface-softened by an acidic environment. The acidic attack resulted in a loss of structural ions from the glass phase of polyacid modified composites. Watts et al (1995) reported that at pH 6-3, hardness decreased by a factor of 5. The pH of Cola soft drink is pH < 3. Hence, this low pH could have caused generalized reduction of microhardness.

In the low intake group of Dyract AP and Fuji II LC restorative materials, statistically no significant reduction of surface micro-hardness was seen. While in medium and high immersion groups of both the restorative materials showed statistically significant ($p<0.01$) reduction in microhardness. This could be

probably because of frequent exposures to the acid pH of the Cola.

Statistically significant difference ($p<0.01$) was seen between Dyract AP and Fuji II LC restorative materials in reduction of microhardness in all the three groups. The VHN of Fuji II LC was higher than those of Dyract AP. But after subjecting to various immersion regimes, the percentage reduction in the VHN values were greater in Fuji II LC given than those observed in Dyract AP group.

The percentage reduction in microhardness is higher in Fuji II LC than Dyract AP probably due to difference in matrix formation. The set cement of Fuji II LC materials have a polyalkenoate network entangled with polymer chain of the HEMA monomer. The higher deterioration of Fuji II LC shows that the coherence of filler particles embedded in the interpenetrating matrices of polyalkenoate and polymers is inferior. This may be caused by the partial replacement of the rigid polyalkenoate network by the flexible polymer chain. A probable reason for a lower difference in base line and final VHN of Dyract when compared to Fuji II LC could be the higher resin component of Dyract (approx. 28%) than Fuji II LC (6%) (Hse et al, 1999; Torstenson et al, 1988). Composite having maximum resin content is not effected by the pH (Chadwick et al, 1990; de Gee et al, 1996).

While comparison of surface microhardness values between low immersion group with medium and high immersion groups showed statistically significant differences, comparison between medium and high immersion showed similar reduction in microhardness. This shows that frequent exposure to these acidic soft drinks may have caused more surface deterioration than low intake.

The present study was a quantitative (surface microhardness and marginal integrity) evaluation and it may not fully reveal the extent of changes occurring. If, combined with qualitative evaluation, it could have revealed the extent of the changes occurring, which could affect the clinical integrity of the material in the oral environment.

Conclusion:

Prolonged exposure to acidic media adversely affected both the marginal integrity and micro hardness of resin modified glass ionomer and compomer. It is clear from the result of this study that the Cola soft drinks affected the marginal integrity and surface microhardness of the Dyract AP and Fuji II LC restorative materials. This study is important because it points to a dietary insult that is wholly preventable. Thus it can be concluded that the frequency of exposure to Cola is directly proportional to the marginal integrity and surface deterioration of the material studied. Both Dyract AP and Fuji II LC revealed similar dye penetration scores. The two materials also showed reduction in surface microhardness under all the immersion regimes. However, the percentage reduction in surface microhard-ness was higher for Fuji II LC than Dyract AP.

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Research Article

Scanning Electron Microscopic Evaluation of Composite Resin-Dentin, Calcium Hydroxide-Dentin and Resin- Calcium Hydroxide Interfacial Gap with Composite Resin Restorations- An *in vitro* Study

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Abstract:

The dental pulp has been shown to have its own reparative capacity and is capable not only of healing but also of providing a dentinal bridge in the absence of calcium hydroxide. The present study was performed to evaluate interfacial gaps formed due to polymerization shrinkage of composite resin. 20 Maxillary or Mandibular, freshly extracted human third molars were prepared and filled using composite with a calcium hydroxide base. The samples were divided into two groups based on primer/bonding agent used i.e. Scotchbond multipurpose (Group I) and Single bond (GroupII). Sectioned samples were gold sputtered and analyzed using Scanning Electron Microscope (SEM). The interfacial gap in specimens belonging to group I and II was observed at the 3 interfaces viz; Calcium hydroxide-dentin interface (A), Composite resin - calcium hydroxide interface (B) and Composite resin - dentin interface (C). The interfacial gap formed between calcium hydroxide and dentin (A) was highly significant ($p < 0.01$) in both groups i.e. Group I and Group II, when it was compared with 'B' and 'C' of the same group. There was no statistical significant difference between group 'B' and 'C'. Thus in both the groups an interfacial gap was found between the calcium hydroxide and dentin. Interposition of calcium hydroxide between tooth and resin possesses some clinical disadvantages and is recommended in selective clinical situations.

Key Words: SEM, Calcium Hydroxide base, Interfacial gap, Composite resin.

Introduction:

Quality and durability of the marginal seal is a major consideration in the selection of a restorative material. Investigators have used composite resin and observed a pulpal reaction that is similar to that obtained when silicate cements are used. It was, therefore considered necessary to protect the pulp dentin organ with liner materials based on calcium hydroxide, thus isolating the dentin from the irritant action of resins (Pashley et al, 1990). These liners provide protection to the pulp-dentin complex by covering the smear plugs and sealing the dentinal tubules against chemical irritants and bacterial invasion (Stanley et al, 1969).

Studies have also demonstrated that dental materials such as silicate cement, zinc phosphate cement, composite resin and amalgam are biologically compatible, even if applied directly to the exposed dental pulp, provided that the latter is hermetically sealed and protected from any subsequent bacterial leakage. Moreover, the dental pulp has been shown to have its own reparative capacity (Cox, 1987), capable not only of healing but also of providing a dentinal bridge in the absence of calcium hydroxide (Kanka, 1990).

The aims of the present scanning electron microscopic study was to evaluate interfacial gaps formed due to polymerization shrinkage of composite resin at

A. The interface between the calcium hydroxide and untreated dentin.
B. The interface between composite resin and calcium hydroxide.
C. The interface between the composite resin and the treated dentinal surface.

Materials and Methods:

a) *Sample Selection* : 20 Maxillary or Mandibular, freshly extracted human third molars were used as samples for this study (Fig. I a). The inclusion criteria comprised of vital maxillary or mandibular molars, which were of similar shape and size. The teeth, which were carious, fractured, or had undergone any regressive alterations like abrasion, attrition or erosion were excluded from the samples. Selected teeth were cleaned free of debris and fixed in 10% neutralized formalin solution before subjecting to further treatment.

b) *Methodology:* Exactly 2 mm deep heels were made on the buccal surfaces at the center of cemento-enamel

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Fig. I a: Samples before preparation (Occlusal and buccal view).

Fig. I b: Samples after 2mm preparation (Occlusal and buccal view).

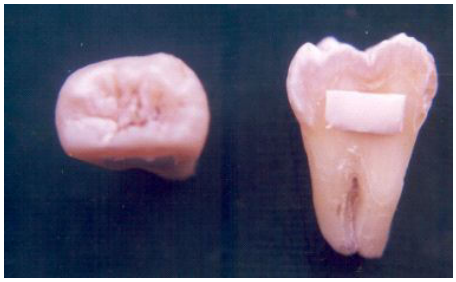

Fig. I c: Samples after calcium hydroxide placement (Occlusal and buccal view).

Fig II a: Samples after composite placement (Occlusal and buccal view).

junction of each tooth by measuring the depth of heels with Williams graduated periodontal probe. The buccal surface of each tooth was then ground flat with a water cooled orthodontic cast trimmer until the heels disappeared. (Fig. I b)

A self-hardening calcium hydroxide, catalyst and base (Dycal) was mixed on a paper pad with spatula and a thin layer of 4 x 2 dimension was applied over the exposed dentinal buccal surface, adjacent to the area of pulp chamber (Fig. I c). After the calcium hydroxide was allowed to set, these specimens were divided into the two groups having ten teeth in each group.

Group I (Scotch Bond Multipurpose):

The remaining exposed enamel and dentinal surfaces, which were not covered by calcium hydroxide were etched with scotch bond multipurpose etchant gel for 15 seconds. Etchant was rinsed for 10 to 15 seconds with a water spray. The etched surfaces were dried for 5 seconds by a gentle blow of dry air. Scotch bond multipurpose primer was applied over the calcium hydroxide and etched dentinal surfaces with the help of sable brush and gently dried for 5 seconds with dry air until the shiny surface was established. The scotch bond multipurpose adhesive (bonding agent) was then applied to primed calcium hydroxide and dentinal surfaces with the help of sable brush and light cured for 10 seconds. Hybrid composite resin (Z 100, 3M, ESPE) was applied over the entire dentinal surface including calcium hydroxide until the original bucco-lingual width (2mm) was obtained and was light cured for 40 seconds (Fig. II a).

Group II (Single Bond):

In this group remaining exposed enamel and dentinal surfaces were etched with 37% phosphoric acid gel for 15 seconds. The etchant was rinsed for 10 seconds with a water spray with the help of two way (air water) syringe. Then the etched surfaces were dried for 5 seconds by gentle blow of dry air by leaving the surface moist. Using fully saturated brush tip, two coats of single bond primer/adhesive were applied over the etched surface including calcium hydroxide and light cured for 10 seconds. Then 2mm thick layer of hybrid (Z 100, 3M, ESPE) composite resin was applied over the entire dentinal surface including calcium hydroxide and light cured for 40 seconds. The 2mm thickness was standardized as in group I.

The specimens of both the groups were mounted vertically by half embedding of the root portions in plaster of paris. The teeth were then sectioned with a diamond disc along the longitudinal axis, thus passing through the center of the restoration (Fig. II b) Sectioned surfaces were cleaned with 10% orthophosphoric acid for 3 to 5 seconds and quickly rinsed with air water spray for 15 seconds to remove smear layer. Later all the specimens were dehydrated

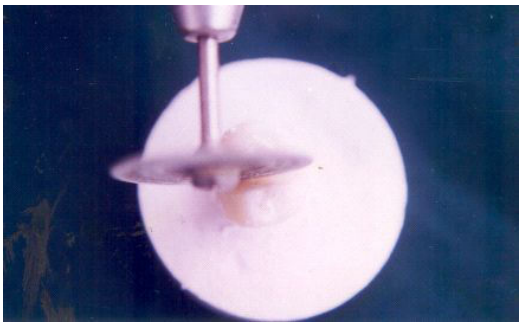

Fig. II b: Sectioning of sample

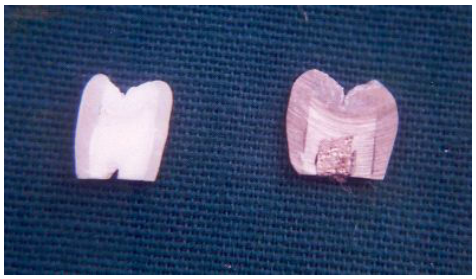

Fig. II c: Gold sputtered sample

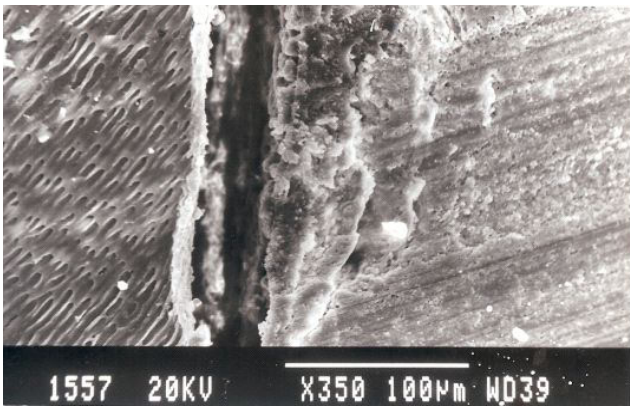

Fig. III a: Calcium hydroxide- dentin & composite-calcium hydroxide interface(group I-scotchbond) 350x.

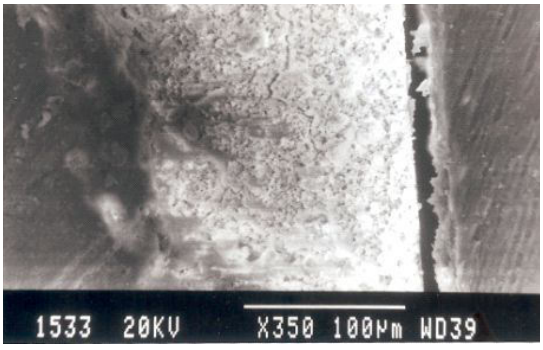

Fig. III b: Calcium hydroxide- dentin & composite-calcium hydroxide interface(group II-single bond) 350x.

by increasing concentrations of ethyl alcohol (30%, 50%, 70%, 90% and 100%). Once the specimens were dehydrated with various concentrations of alcohol, they were mounted with silver paste on metallic stubs and gold coated with a sputtering system under vacuum desiccation (Fig. II c) and then examined under scanning electron microscope at an acceleration voltage of 7 to 10 KV.

The interfacial gaps between the calcium hydroxide and unetched dentinal surface (A), composite resin-calcium hydroxide (B) and composite resin-etched dentin (C) were observed under scanning electron microscope. Representative photomicrographs were taken at a magnification of x 100, x 350 and x 3000. The interfacial gaps at three different levels were measured in each photomicrograph and the mean was taken. The values were first obtained in mm and were then converted into micron. Intergroup and Intragroup comparison of interfacial gaps were made by using one way ANOVA and individual group comparison was assessed by Newman - Keul's studentized range test.

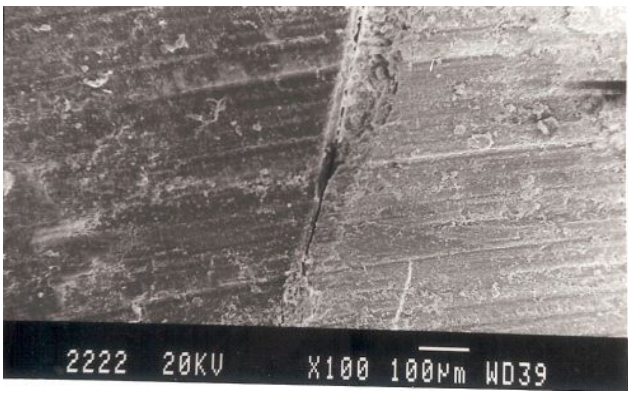

Fig. IV a: Composite-dentin interface in lower magnification 100x.

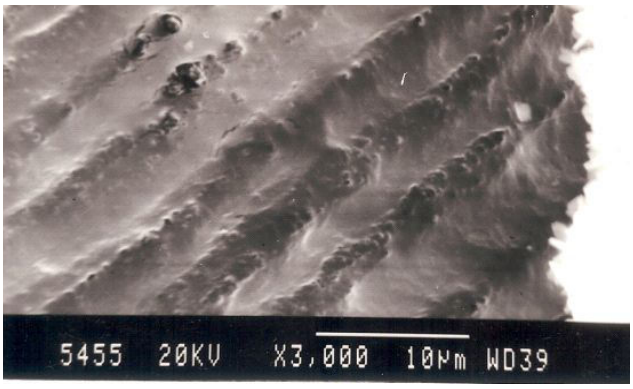

Fig. IV b: Composite – dentin interface in higher magnification 3000x.

Results:

The amount of interfacial gap in specimens belonging to group I and II was observed at the following 3 interfaces

A. Calcium hydroxide - dentin interface (Fig. III a & III b).
B. Composite resin - calcium hydroxide interface (Fig. III a & III b).

C. Composite resin-dentin interface (Fig. IV a & IVb).

The amount of interfacial gap formed between calcium hydroxide and dentin was highly significant ($p < 0.01$) in both groups i.e. group I and group II, when compared with (B) and (C) of same group. There was no statistical significant difference between 'B' and 'C' (Table I & II).

The Snedecor's 'F' test also showed that there was no statistical significant difference with all three interfacial gaps between the group I and group II (Table III).

Table I: Comparison of interfacial gaps in scotch bond multipurpose adhesive (Group I)

Interfaces	No. of Specimens	Interfacial gap (μm) Range	Mean ± SD	Difference Comparison	Significance
A.Calcium hydroxide dentin interface	10	12.6-42.9	26.1 8.45	A-B	p<0.01
B. Composite resin calcium hydroxide interface	10	0-17.6	4.6 6.71	A-C	p<0.01
C. Composite resin dentin interface	10	0-16.0	4.1 6.35	B-C	NS

*one way ANOVA and studentized Range test (Min. Sig. Diff. = 10.3 μm), p < 0.01 = Very significant, NS = Not Significance

Table II : Comparison Of Interfacial Gaps In Single Bond Adhesive (Group II).

Interfaces	No. of Specimens	Interfacial gap (μm) Range	Mean ± SD	Difference Comparison	Significance
A. Calcium hydroxide dentin interface	10	11.8-48.2	26.2 13.60	A-B	p<0.01
B. Composite resin calcium hydroxide interface	10	0-11.1	2.7 4.58	A-C	p<0.01
C. Composite resin-dentin interface	10	0-13.0	1.8 4.24	B-C	NS

* one way ANOVA and studentized Range test (Min. Sig. Diff. = 10.3 μm), p< 0.01 = Very significant, NS = Not Significance

Discussion

During sample preparation the buccal surface was taken as dentin bonding site. This was done to get a consistent superficial dentin and on flat surfaces tensile stresses can be more producible. On flat dentin surface, the bond strength could withstand the contraction forces. This configuration allowed a large, free and unbonded surface, which permitted the flow of the resin across the free surface during its polymerization shrinkage, thereby minimizing stresses at the bonded surface as suggested by Davidson & de Gee (1984). In this study (Z 100, 3M, ESPE) hybrid composite resin was used because photo polymerizing hybrid composite resins develop higher polymerization shrinkage stresses than micro filled composite resins (Feilzer et al, 1990).

Table III: Comparison of Interfacial Gaps in Group I and Group II.

Interfaces	Scotch Bond Multipurpose Group I (n=10) Mean ± SD	Single Bond Multipurpose Group I (n=10) Mean ± SD	Significance of difference
A. Calcium hydroxide dentin interface	26.1 8.45	26.2 13.6	NS
B. Composite resin calcium hydroxide interface	4.6 6.71	2.7 4.58	NS
C. Composite resin dentin interface	4.1 6.35	1.8 4.24	NS

* Snedecor's 'F' test (Two sample comparison), NS = No.Significance

After the conditioning procedure, the buccal surfaces of both groups were kept moist. In the presence of moisture, primer (or) primer/adhesive, can more readily wet the dentin surface and penetrate in to the tubules and demineralized dentin. A collapse of the collagen structure is thus prevented. Kanaka (1992) reported that this might account for the rapid development of a resin impregnated layer over the entire internal dentin area that is able to resist polymerization shrinkage forces originating from the curing of the composite.

Scotch bond multipurpose consists of hydroxy ethyl methacrylate (HEMA), polyalkenoic acid co-polymer, water and bis-phenyl glycidal methacrylate where as Single bond consists of hydroxy ethyl methacrylate, polyalkenoic acid co-polymer, water and bis-phenyl glycidal methacrylate, ethanol. Acetone and alcohol effectively displace water and therefore, are better facilitators of resin primer infiltration in to the collagen network compared to water based adhesive systems (Kanaka, 1992).

In the present study, the amount of interfacial gap found between the calcium hydroxide and dentin in Scotch bond multipurpose as well as Single bond treated composite resin was same. Using SEM, Goracci & Mori (1996) found that the gaps were mainly due to the polymerization shrinkage of the

composite, which caused the detachment of the calcium hydroxide from the dentinal surface. Reinhardt & Chalkey (1983) reported that calcium hydroxide does not adhere to the smear layer or to the dentinal tubule complex. Due to poor adhesion of calcium hydroxide to the dentinal surface, the polymerization shrinkage of the composite resin caused detachment of the calcium hydroxide, leading to the formation of an interfacial gap. This observation is in agreement with other clinical studies (Ben-Amar et al,1991; Gwinnett, 1988; Chan and Swift,1989; McConnell, 1986).

Brannstrom et al (1991) reported that such a interfacial gap will be quickly colonized by pulpal fluids and because of inward and outward fluid movement, most of the calcium hydroxide material paste will disappear with time. This observation is in agreement with other clinical studies (Barnes & Kidd, 1979).

Inter group comparison between Scotch bond multipurpose group and single bond group (Table III) showed no significant difference in the amount of gap formed between calcium hydroxide and dentin (A). No significant difference between composite resin-calcium hydroxide interface (B) and composite resin-dentin interface.

The interface between the calcium hydroxide and composite in both the groups showed a gap free attachment. Ben-Amar et al (1991) explained this by the occurrence of a chemical reaction or by mutual dissolution of the components at the Interface.

Composite resin-dentin, interface in Scotch bond multipurpose and Single bond group showed a gap free attachment at x 100 magnification and hybrid layer and resin tag penetration at x 3000 magnification. This result is consistent with other clinical studies (Goracci et al, 1994, Marcos et al, 1997).

This *in vitro* study showed a significant gap between the calcium hydroxide and dentin in both groups as a result of polymerization shrinkage of composite resin, which has been treated with scotch bond multipurpose and single bond adhesive systems.

Interposition of calcium hydroxide between tooth and resin possesses some clinical disadvantages such as calcium hydroxide material itself can prohibit proper polymerization of the composite resin (Marshall et al, 1982). Calcium hydroxide occupies some of area that could have been used for dentinal bonding (Heitmann & Unterbrink, 1995), phosphoric acid etching weakens or dissolves the calcium hydroxide material (McComb,1983; Hwas & sandrik,1984). Calcium and hydroxide under restorations may disappear with time (Barnes and Kidd, 1979), hence, it should be recommended in selective clinical situations. This vitro study can only simulate the clinical conditions as closely as possible. Identical simulation cannot be performed exactly. Questions regarding the durability of the composite dentin bond and the relationship between marginal adaptation in vitro and bacterial contamination and development of secondary caries *in vivo* requires further study.

Conclusion

1. In both the groups an interfacial gap was found between the calcium hydroxide and dentin.
2. Amount of interfacial gap formed between composite resin-calcium hydroxide and composite resin-dentin interfaces is not statistically significant.
3. Total bonding area may be an acceptable alternative procedure, rather than the selective bonding area.
4. The latest dentin bonding systems recently marketed forms an inter-diffusion layer with higher bond strengths, which are excellent for clinical usage.
5. Interposition of calcium hydroxide between tooth and resin possesses some clinical disadvantages. Hence should be recommended in selective clinical situations.

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Case Report

Full Mouth Rehabilitation with Fixed and Removal Prosthesis using Extracoronal Attachments: A Clinical Report

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Abstract:

Full mouth rehabilitation always claims careful attention and meticulous treatment planning. It becomes more challenging with the partial edentulism where bilateral segment is found missing. Successful restoration can be done with plenty of contemporary and conventional treatment planning. Attachment retained partial dentures are one such kind of treatment modality in prosthodontics. Studies have also demonstrated that precision-attachment partials last longer, wear less, need less adjustments, look better, work better, less destructive, protect abutment teeth, and are easier to clean. In this case report patient's functional and aesthetic expectations were met by doing full mouth rehabilitation using combination of Porcelain fused to metal (PFM) restorations and semiprecision attachments.

Key Words: Full mouth Rehabilitation, Implant Retained Denture, Semi-Precision Attachments, Cast Partial Denture (CPD), Vertical Dimensions (VD).

Introduction:

The demand for treatment with different partial denture prostheses is increasing (Douglass & Watson, 2002). Various treatment-planning modalities can be made for restorations in patients who have lost either upper or lower posterior teeth, unilaterally or bilaterally, and have no distal abutments.In such partial edentulism, implant-assisted prosthodontics has become contemporary choice of the replacement of the natural teeth. Although, conventional methods of fabrication of the removable partial denture continues to be an essential prosthetic consideration in many oral reconstructions, especially when implant therapy may not be used to replace missing natural teeth for some patients.

In modern dental practice many published paper suggested the application of implants in partially edentulous patients, serving as abutments for single crowns or fixed prostheses (Ericsson et al, 1986; van Steenberghe, 1989). Moreover, there is a paucity of studies concerning the combination of implants and removable partial dentures. However, in many partially edentulous situations the combination of implants and fixed restorations is difficult to implement (Battistuzzi et al, 1992). Contraindications can be based on medical, anatomical factors, such as the mandibular nerve or extension of the maxillary sinus, or costs involved with implant treatment.

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These limitations are mostly encountered in maxillary or mandibular posterior distal extension cases. The other problem occurs when the distal extension removable partial denture (RPD) is subjected to vertical, horizontal and torsional forces and that may become adverse during functional and parafunctional activities. These forces, which can affect denture retention, stability and support, are often compensated for to some extent by framework and denture base design variations. Removable partial dentures can be made with or without a cast framework. The partial cast has historically been the option of choice for the same. However, both the methods initiate new complaint regarding the appearance of the dentition as element of the denture framework or acrylic resin becomes visible.

Many patients are disappointed after placement of cast removable partial dentures (RPDs) because the patient refuses or is unable to wear the denture and the treatment is, therefore, deemed unsuccessful. Rates of unsuccessful treatment for clasp retained cast RPDs range from 3% to 40% with mean being 26% (Frank et al, 1998). Patients seek treatment with cast RPDs for the purpose of improving appearance and masticatory function. It has been suggested that compliance improves when the prosthesis meets the aesthetic requirements of the patient (Mazurat & Mazurat, 2003).

A number of reports have been published regarding the framework and the direct retainer designs to improve the comfort and acceptance of the patient, wearing RPDs. Towards the end of the 19th century Parr, Peeso, Chayes, designed gadgets subsequently

called precision attachments. These attachments allowed prostheses to combine the advantages of fixed and of removable restorations (Preiskel, 1974). An attachment is a precision connector made up of two parts one part is connected to a root, a tooth or an implant. The other part to an artificial prosthesis, and is used to provide mechanical connection between the two. For the most part attachments take the place of damaging clasp arm but can also be used to retain full or partial dentures on root anchors carrying studs and bars (Sherring & Martin, 1994). Precision/Semi-precision RPD is the treatment modality that can facilitate both an aesthetic and a functional replacement of missing teeth and oral structures.

Indication of the attachment according to Sherring & Martin (1994) are:

1. Fixed bridgework- Intracoronal attachment on non parallel abutments
2. Partial Denture
3. overdentures
4. Unilateral or bilateral free end denture.

Classification of Precision Attachments:

Attachments have been designed since the past century and more than 100 types are available. There are many different types of prefabricated attachments available and they are usually classified on:

(1.) Basis of location or shape and form:

1. Extracoronal, 2. Intracoronal,
3. Radicular stud and 4. Bar.

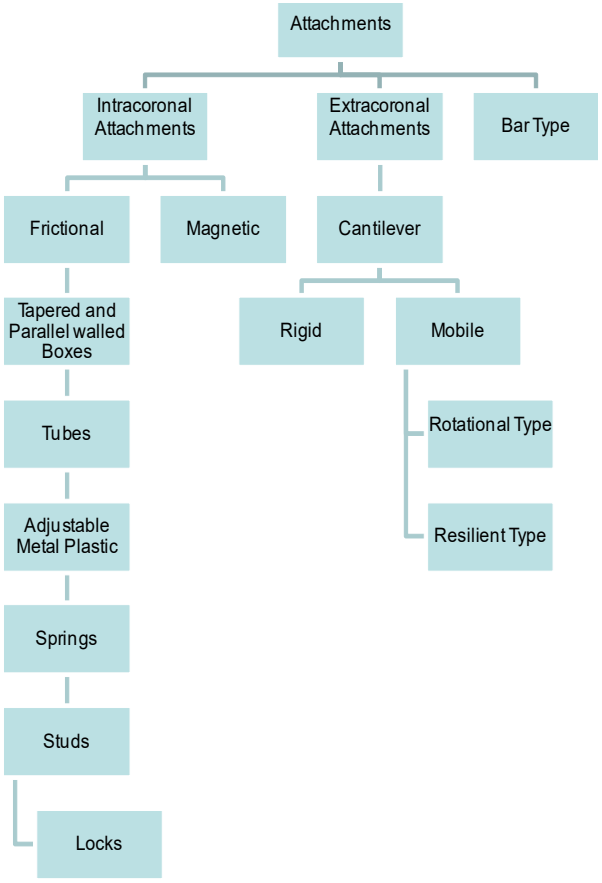
(2.) Based primarily on the function of the attachments (Feinberg & Feinberg, 2002):

1. Rigid: Any attachment employing a mechanical locking action with the use of clasps, lingual arms, springs, ball and sockets etc. The removable partial denture is held firmly in place and the abutment teeth are subjected to all of the forces in the mouth at all times.

2. Passive: An attachment that provides a free movement of the male when the abutment teeth are exposed to excessive forces. Such a passive retention mechanism has the effect of an automatic stress-breaker.

Becerra & MacEntee (1987) has described the other system of classifying the attachment to provide an overview of the designs available and to identify the common feature of each class.

While the fixed bridge or clasp-retained denture is usually the restorations of choice, attachments have to be employed where neither of these two would be



satisfactory. There is no universal or ideal design is available, so if attachments are used, they should be selected from the group with the most suitable characteristics for the task required. However, the principle concern is always the distribution of forces to maintain remaining alveolar ridges and teeth in an optimal state of health and to provide the patient with improved comfort and function.

Case Report:

The patient was 63 year old male complaining of inability to masticate and unesthetic facial appearance. He was referred by his dentist to the department of prosthodontics, People's Dental Academy, Bhopal for better prosthodontic consultation to address regular complaints by him regarding the inability to chew and speak properly. Patient was wearing mandibular temporary partial denture unsatisfactorily and having complaints of poor appearance, pain, and looseness in maxillary artificial teeth.

On clinical diagnosis, mobility and tenderness was found in PFM maxillary anterior bridge in relation to 12, 11, 21 ,22 and splinted metal crowns with #

acrylic facing in relation to 13,14,15, abfraction in teeth 23, 24 25. Grade II mobility in 42 and hypermobility in teeth 41and 32, clinically missing 31, root canal treated 46 with furcation involved, in addition he had other severe problems i.e. supraeruption in mandibular anterior teeth, mesially tilted molar tooth number 36, loss of incisal guidance and unsatisfactory occlusion. Anatomic landmarks, facial measurements and the resting positions of mandibular jaw were used to determine appropriate vertical dimension for the patient. As a result, it was found that previous restorations were given in the increased vertical dimension. Although, he had no specific medical history and dysfunction habit.

As his gingival status found compromised, after the initial clinical examination patient was referred for periodontal therapy followed by removal of the faulty bridges under local anaesthesia. Full mouth series of IOPA (Fig.I) and OPG were taken and examined. Teeth 12, 32, 41 and 46 had poor prognoses and hence they were extracted. After surgical intervention intraoral & extraoral condition was analysed (Fig. II and III), then different treatment plans ranging from conventional RPD to implants were made and discussed with the patient to restore the function and aesthetics of the dentition.

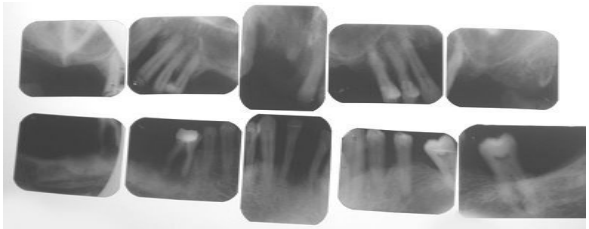


Fig. I: Showing the full mouth series of IOPA X-ray

Fig.II: Showing Pre treatment intra-oral view of patient's teeth in occlusion after removal of previous restorations.

Examination of radiograph and anatomical factors like maxillary sinus floor position and residual ridge resorption, patient was made aware of the steps involved before and during the surgery. He showed

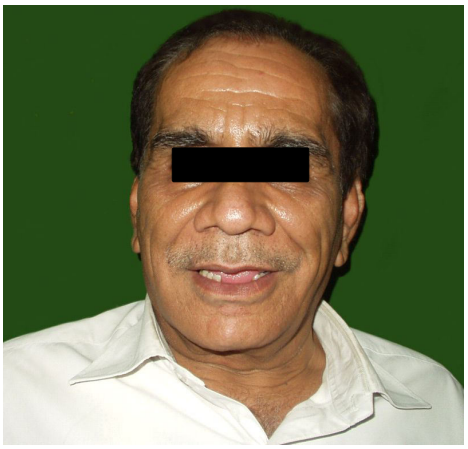


Fig. III: Showing Pre treatment extra-oral view of the patient's smile.

fear of surgery, financial limitations and dissatisfaction from the previous clasps retain RPD. For these reasons, instead of implant prosthesis, combination of fixed and fixed removal prosthesis in a form of extracoronal attachment was suggested to the patient and its advantages and disadvantages were also discussed. After taking patient's approval clinical procedures were initiated.

Impressions were made with alginate and casts were poured. Occlusal wax rims were fabricated on the diagnostic casts and later they were mounted in centric relation for prosthodontic evaluation. As teeth were found supraerrupted, tilted, and with unfavourable crown root ratio (Fig. IV), mock crown preparation was done on the diagnostic casts to analyse the required removal of tooth structure to reduce the vertical dimension crown root ratio. Radiographs were used as reference. New reduced VD is planned for aesthetic and functional restoration and established in the articulator. Teeth arrangement was done using occlusal wax rims for the purpose of try-in. Putty indexes were made ready to transfer the mock preparation records intraorally for required preparation of the teeth. Diagnostic wax-up on the teeth was done on the cast. Another set of putty index was made to fabricate the temporary restorations.

All the teeth were prepared and old crown preparation were modified with the help of putty index. Temporary restoration was fabricated with Protemp (3M ESPE Dental Products, St. Paul, USA), finished and cemented with temporary cement. Try-in of temporary partial denture was also done. Clinical diagnostic tests were repeated to check the patient's comfort at new vertical dimension. While patient was wearing provisional restoration for 3 months occlusal stability and TMJ were periodically checked.

The patient was satisfied with the provisional restoration. Thus, it was decided to reproduce the temporary VD and centric relation (CR) state on the final restoration.

Gingival displacement was done using double cord technique with (Ultradent Products Inc., Salt Lake city, Utah) Definitive impressions were made with polyvinyl siloxane impression material using putty wash technique. Working cast was generated from die stone type IV (Kalrock, Kalabhai Karson Pvt. Ltd.,Mumbai), surveyed and mounted with help of temporary record base and interocclusal records.

The wax patterns were prepared for PFM crowns and semi-precision attachments were attached distal to the distal abutment using surveyor. Casting, finishing, metal coping try-in and shade selection were done. Temporary denture base were adjusted to accommodate the semi-precision on attachment. Posterior teeth arrangement and PFM crowns were prepared and try-in was carried out. Clinical adjustments were done. The glazing of PFM crowns and acrylization of attachment retained partial dentures were completed. Pink colour rubber rings were placed (as manufacture's instruction) in the female counter part slots present in the CPD using inserting tool (Fig. V). These rubbers make the CPD retentive and stable and at the same time act as stress breakers.

Fig. IV: Showing Intraoral view of left mandibular teeth showing supraerruption in premolars and mesial tilt of first molar.

Crown and bridges were cemented with the CPD attached (Fig. VI). Extra care was taken during cementation by applying petroleum jelly to the attachments and all parts of CPD to make removal of access cement easy (Fig. VII & VIII). After the final set-up, routine check-ups were performed in every 3 months for one year. The final result satisfied the patient's chief complaints with the combination fixed partial dentures and semi precision retained CPD which produced stable occlusion obvious, improvement in the mastication and better aesthetics (Fig. IX and X).

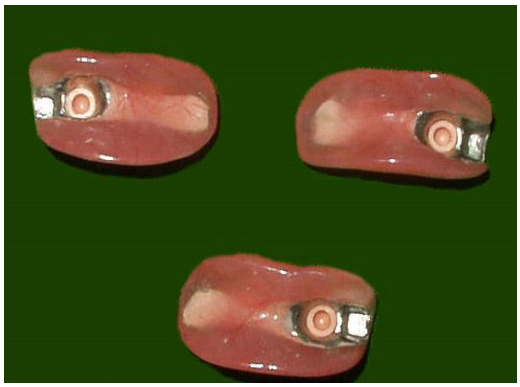


Fig. V: Showing placement of pink colour rubber rings in the female counter part slots present in the CPD.

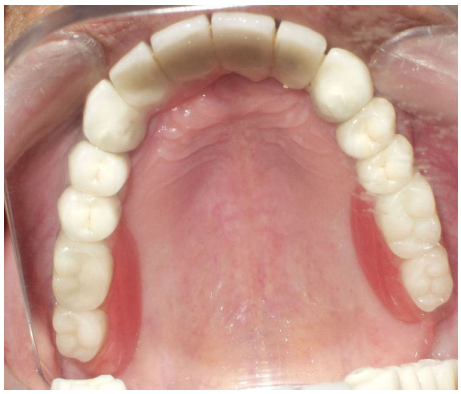


Fig. VI: Showing intra-oral view after the cementation of crown and bridges with the CPD attached.

Fig. VII: Showing intra-oral view of semiprecision attachment in right mandibular arch.

Discussion:

Removable partial dentures (RPD) have provided a viable treatment for partially edentulous patients. There are several treatment options for rehabilitation of partial edentulism including the use of conventional or implant-retained fixed prostheses.

Fig. VIII: Showing intra-oral view of semiprecision attachment in maxillary arch bilaterally.

Fig.IX: Showing Post treatment intra-oral view of restoration in occlusion

Depending on several given diagnostic factors and patient's perspective best treatment plan should be selected for the patient.

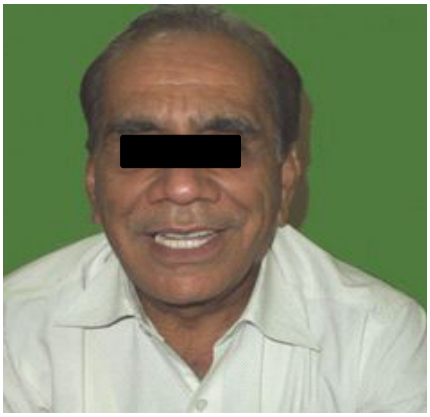


Fig. X: Showing post treatment extra-oral view of the patient's smile.

New technologies have been dramatically improving the quality of removable partial denture and the lives of patients, who use them. In recent year, dentistry has witnessed use of Computer added design Computer added milling (CAD-CAM) (William et al, 2006; Eggbeer et al, 2005), precision milled and semiprecision attachments, improved impression materials, improved techniques and designs.

Precision attachments have been used in removable and fixed prosthetics for years and have contributed to the success of RPDs, overdentures, segmented fixed prosthetics, and implants. Removable partial dentures fabricated with precision/Semi precision attachments for retention and support are the best prosthesis available to dentistry where fixed restorations are contraindicated (Feinberg & Feinberg, 1984).

There are number of attachments available now. At the same time, attachments are being used in all manner of restorative procedures, from partial dentures to implant-based prostheses. No single attachment is perfect for every application, it is critical that the appropriate attachment be utilized for each individual case situation. By analysing study models and x-rays, the clinician can make several important determinations, each of which will influence final attachment selection.

There is significant number of patients who could benefit from this treatment option, both long and short term. The survival rate of semiprecision attachment is quite satisfactory. Few retrospective studies available show a survival rate of 83.3% for 5 years, of 67.3% up to 15 years and of 50% when extrapolated to 20 years (Owal, 1991, 1995).

Other studies have also demonstrated that precision-attachment partials last longer, wear less, need less adjustments, look better, work better, are less destructive, protect abutment teeth, are easier to clean, and are worn most of the time by patients who have them (Feinberg, 1982).

Hedzelek et al (2011) conducted a Study to evaluate the repeatability of producing the semi-precision attachment; to establish their estimated longevity by a simulated, repeated denture placement/ removal procedure of denture; and to investigate the wear of their components. Results suggest that the inaccuracies of casting and laboratory procedure have only limited influence on the fit of the semi-precision attachments. The attachment with metal-to-metal type of friction exhibits the highest wear resistance (simulated up to 8 years of usage) as compared to attachments with polymeric matrix (up to 3 years) (Hedzelek, 2011).

Kapur et al (1994) has suggested in his clinical study that splinting of first and second premolars by full coverage crown, has provided good support and improved prognosis of CPD. With the having same reference it was planned in this case and premolars were splinted together to support the CPDs.

The attachments have additional benefits like enhanced retention, stability and aesthetics. This is a viable alternative for the patients who are not prepared to undergo surgical procedure involved in implant supported prosthesis.

Conclusion:

The primary objective of prosthodontics must be the preservation and health of the remaining existing tissues and structures: teeth, periodontal tissues, temporomandibular joint and oral facial muscles. In the present case patient was previously treated with the poorly planned restorations which were not fabricated by considering prosthodontic principles. As a result old restorations could not satisfy patient's realistic expectation and along they were causing more destruction to oral structures.

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Case Report

Bilateral Three Headed Biceps Brachii - A Case Report

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Abstract:

Bilateral three-headed biceps brachii muscle was found in a sixty-year-old male cadaver. The supernumerary head took origin from the site of insertion of coracobrachialis and inserted into the common tendon of biceps brachii. Presence of this bilateral occurrence will be important for surgeons and traumatologists as this might cause compression of musculocutaneous nerve or median nerve.

Key Words: Biceps brachii, Supernumerary head.

Introduction:

Biceps brachii is one of the most variable muscle in the human body in terms of number and morphology. The biceps brachii is classically described as a two headed muscle, that originates proximally with a long head from the supra glenoid tubercle and a short head from the coracoid process of scapula. The supernumerary heads might cause confusion to a surgeon or they might cause compression of neurovascular structures in upper limb (Warner et al, 1992). It is well known that a third head may extend from superomedial part of the brachialis to the bicipital aponeurosis and medial side of tendon in ten percent of cases (Williams et al, 1989).

Case Report:

During routine dissection of upper limb for under graduate students, a supernumerary third head of biceps brachii was found bilaterally in a sixty-year-old male cadaver. Both short and long heads have their normal origins and insertions bilaterally. On the right side most of the fibers of the additional third head originated from the antero medial surface of humerus at the point where coracobrachialis is inserted and some fibers arose from the deep fascia surrounding brachialis muscle and joined the common biceps brachii tendon for insertion. The additional head was innervated by musculocutaneous nerve after piercing coracobrachialis, similar to the innervation of long and short heads and continued as lateral cutaneous nerve of fore arm passing between brachialis and biceps brachii (Fig. I).

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Fig.I: Showing 3rd head of Biceps Brachii in Right Upper Arm. (LBB- Long head of biceps brachi, SBB- Short head of biceps brachi, 3BB - Third head of biceps brachi, CB- Coracobrachialis, MC- Musculocutaneous nerve).

The origin of third head on left side was similar to that of right side, however, third head was pierced by the musculocutaneous nerve which continued later as lateral cutaneous nerve of fore arm (Fig. II).

Discussion:

The incidence of supernumerary heads of biceps brachii range from 9.1% to 22.9%. Out of this the third head is reported in 7.5% to 18.3% cases. Incidence of unilateral three headed biceps brachii is common, a rare occurrence of bilateral supernumerary heads of biceps brachii was reported by Kosugi et al (1992). The supernumerary heads of biceps brachii muscle are classified according to their locations as superior, infero-medial and infero-lateral heads (Rodriguez – Niedenfuhr et al, 2003). Though most of the supernumerary heads of biceps brachii muscle belong to these three groups, rare variations like

Fig. II: Showing musculocutaneous nerve piercing 3rd head of biceps brachii in Left Upper Arm.
(LBB- Long head of biceps brachi, SBB- Short head of biceps brachi, 3BB - Third head of biceps brachi, MC- Musculocutaneous nerve)

acromial, labral and pectoral heads have also been previously reported (Testut, 1883). In the present case the accessory third head of biceps brachii mainly arose from antero-medial surface of shaft of humerus just lateral to the insertion of coracobrachialis as was reported by Asvat et al (1993) and Rodriguez-Niedenfuhr et al (2003), and between the bellies of biceps brachii and brachialis muscles and fused with the posterior aspect of common biceps tendon as described by Swieter & Carmichael(1980). Embryological observations by Testut (1902) described this variation of third head of biceps brachii as a portion of the brachialis muscle supplied by the musculocutaneous nerve in which its distal attachment (insertion) has been translocated from ulna to the radius. The accessory third head may not give extra strength and may not cause an unusual displacement of fracture fragments of humerus; however, this extra head might cause compression of the Median nerve since it might pass between fibres of accessory head. This might also cause engorgement of veins because of compression exerted by the accessory biceps brachii. Biceps brachii will be useful as a component of flap surgery Mas et al (2006); in such cases the knowledge of the innervation of accessory head as well as the compression of vasculature will be very much required by surgeons.

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Case Report

Unicystic Ameloblastoma Presenting as Multilocular Lesion: A Case Report

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Abstract:

Unicystic ameloblastoma (UA) refers to those cystic lesions that show clinical, radiographic, or gross features of a mandibular cyst, but on histological examination show a typical ameloblastomatous epithelium lining part of the cyst cavity, with or without luminal and/or mural tumour growth. In this case report we present a uncommon multilocular unicystic ameloblastoma encountered in a 40 year old female patient.

Key Words: Unicystic ameloblastoma, unilocular, multilocular

Introduction:

Many benign cysts and tumours involve mandible; these can be of odontogenic origin or of nonodontogenic origin. Lesions include ameloblastoma, radicular cyst, dentigerous cyst, keratocystic odontogenic tumour, central giant cell granuloma, fibroosseous lesions and osteomas (Kahairi et al, 2008). The most common tumours of odontogenic origin are ameloblastomas, which develops from epithelial cellular elements and dental tissues in their various phases of development. Much confusion still exists, when it comes to the terminology used for unicystic ameloblastomas (UAs). Some of the terms used for this lesion prior to 1977, when Robinson & Martinez (1977) introduced the concept of UA, were cystic (intracystic) ameloblastoma, ameloblastoma associated with dentigerous cyst, cystogenic ameloblastoma, extensive dentigerous cyst with intracystic ameloblastic papilloma, mural ameloblas-toma, dentigerous cyst with ameloblastomatous proliferation, and ameloblastoma developing in a radicular cyst. The term unicystic is derived from the macro and microscopic appearance, the lesion being essentially a well-defined, often large monocystic cavity with a lining, focally but rarely entirely composed of odontogenic (ameloblastomatous) epithelium. Much confusion stems from the fact that a unicystic ameloblastoma may appear not only as a unilocular but also as a multilocular bone defect (Eversole et al, 1984; Li et al, 2000). We present a case of a large unicystic mandibular ameloblastoma in a 40 year old female with a relatively rare multilocular appearance.

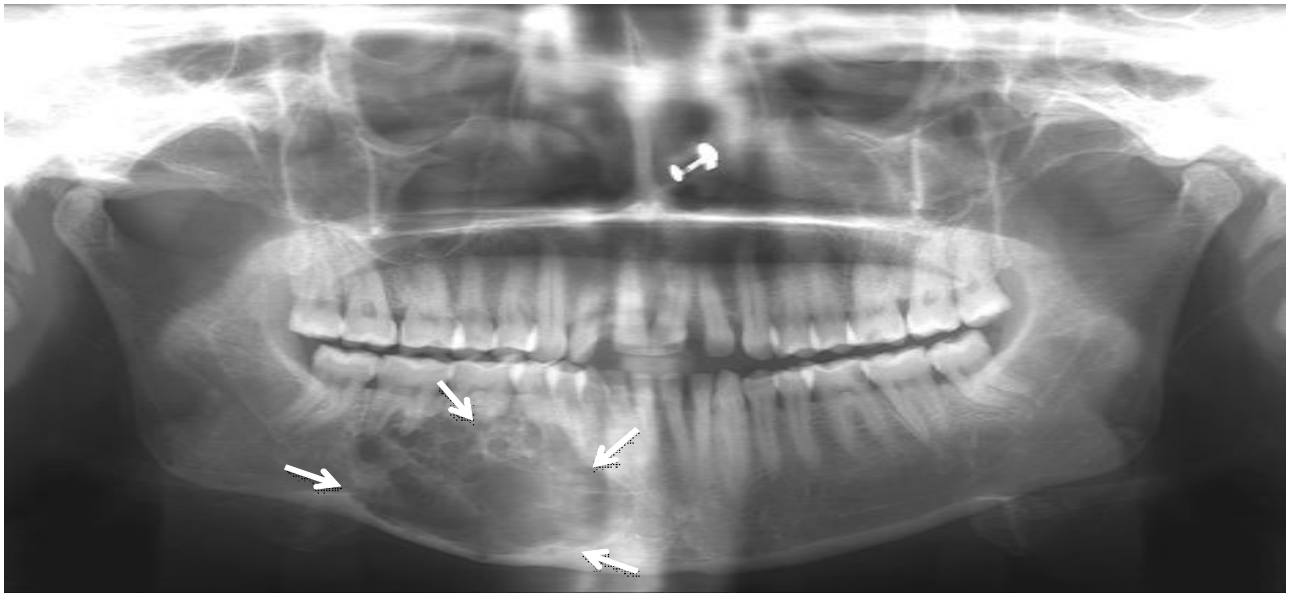

Fig. I: Orthopentogram showing multilocular radiolucency in association with 43 to 47

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Case report:

A 40-year-old female patient presented to the Department of Oral Pathology & Microbiology with swelling on the right side of the face for last one month. The swelling was approximately 3 X 5 cm in size, associated with dull pain on the lower right side of face. On intraoral examination, the lesion extended from 44 to 46 with obliteration of buccal sulcus. The swelling was tender on palpation. The overlying mucosa was inflammed. Right submandibular lymph nodes were palpable and tender. An orthopantomogram showed large cystic lesion in the right side of mandible, extending anteroposteriorly from 42 to 47 & superior-inferiorly from periapical region of 42 to 47 to the body of mandible. Osteolytic lesion was multilocular also showed root resorption of 45, 46, and 47 (Fig. I). Considering the site, age and it being multilocular a differential diagnosis of ameloblastoma / odontogenic keratocyst was considered. Segmental mandibulectomy was done under general anaesthesia and the specimen was subjected to histopathological examination. The gross specimen (Fig. II) revealed buccal cortical expansion with thinning of cortical plates. No expansion of the lingual cortical plate was noted.

Fig. II: Gross specimen showing cortical expansion and thinning of mandible.

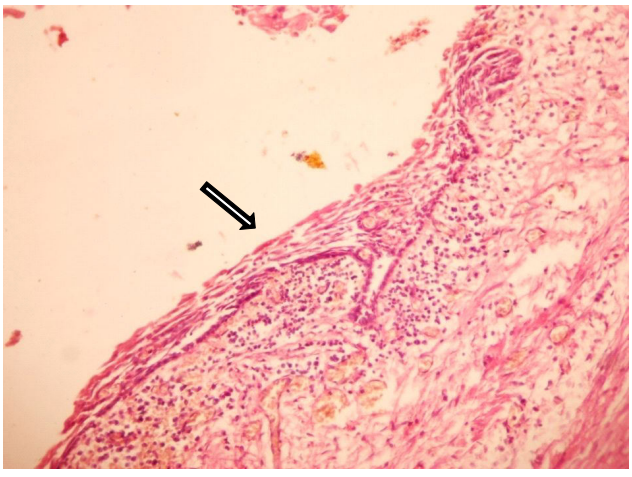

Fig. III: Histological section showing luminal unicystic lining (H&E stain 10X)

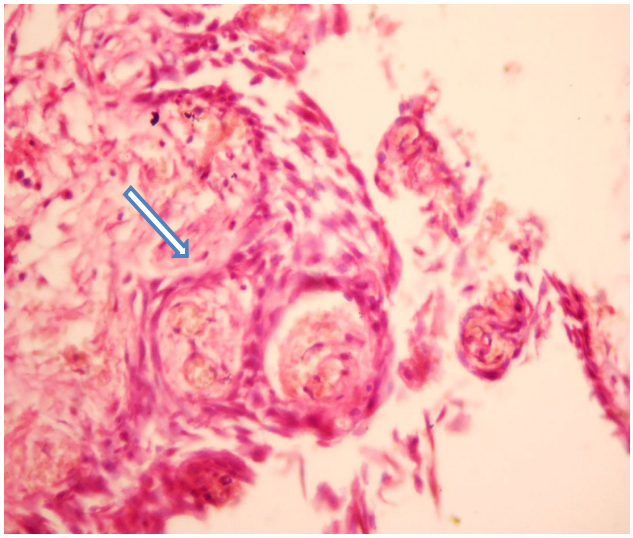

Fig. IV: Histological section showing intraluminal unicystic lining (H&E stain 10X)

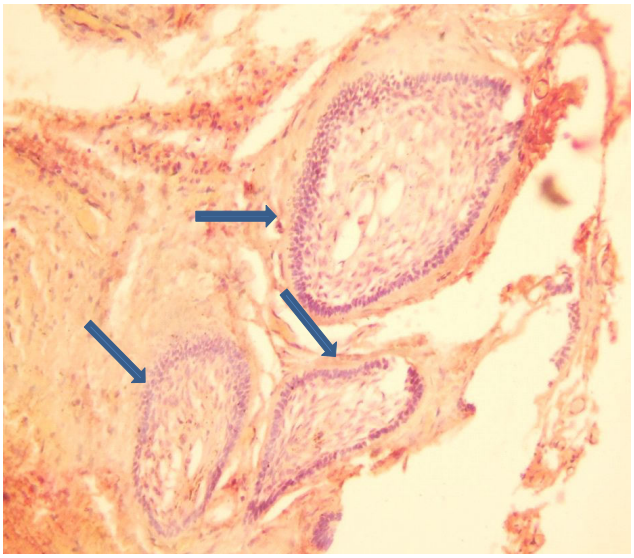

Fig. V: Histological section showing mural follicles in unicystic ameloblastoma (H&E stain 10X).

Histopathological examination revealed presence of an odontogenic epithelium showing Vickers & Gorlins criteria (Vickers & Gorlin 1970) with the intraluminal and mural proliferation of the odontogenic islands and stands. Inflammatory infiltration was also observed (Fig. III, IV, & V). Based on the histopathological findings, diagnosis of unicystic ameloblastoma showing intraluminal and mural proliferation was given.

Discussion:

Ameloblastomas are benign tumours whose important lies in its potential to grow to enormous size with resulting bone deformity. Ameloblastomas are typically differentiated histologically into unicystic intraosseous, multicystic, and solid. The relative frequency of occurrence of unicystic ameloblastoma has been reported as between 5% to 22% of all types of ameloblastomas (Reichart et al, 1995). The mean age at the time of diagnosis differs considerably according to the UA variants. Those diagnosed as dentigerous, occurred in much younger patients with mean age of 16.5 years, 78.3% occurring in the 1st and 2nd decades while for nondentigerous the mean age was 35.2 years with age ranging from 40 to 70 years (Reichart & Philipsen, 2004). In the present case patient was 40-year-old which is in accordance to the literature (Reichart & Philipsen, 2004). The location of the UA within the jawbones shows a marked predominance for the mandible irrespective of the variant.The maxilla: mandible ratio being 1:7 for the dentigerous type and 1:4.7 for the nondentigerous type (Philipsen & Reichart, 1998) as seen in the present case. The radiographic appearance of all UAs is divided into two main patterns, unilocular and multilocular, there is a clear predominance of the unilocular configuration in all studies. This predominance was exceptionally marked for the dentigerous variant where the unilocular: multilocular ratio was 4.3:1.2. For the nondentigerous type this ratio was 1.1:1 (Eversole et al, 1984). The various histological subtypes of unicystic ameloblastoma are determined by the pattern and extent of ameloblastomatous proliferation in relation to the cyst wall. In a clinicopathologic study of 57 cases of unicystic ameloblastoma, Ackermann et al (1988) classified this entity into the following three histologic groups:

Group I: Luminal UA (tumor confined to the luminal surface of the cyst);

Group II: Intraluminal/plexiform UA (nodular proliferation into the lumen without infiltration of tumor cells into the connective tissue wall);

Group III: Mural UA (invasive islands of ameloblastomatous epithelium in the connective tissue wall not involving the entire epithelium)

On histopathology of the present case, luminal, intra luminal and mural type of ameloblastomatous proliferation was present. This type of UA can be better classified as subgroup 1.2.3 according to Philipsen & Reichart (1998) who have categorized UA into: Subgroup 1: Luminal UA; Subgroup 1.2: Luminal and intraluminal; Subgroup 1.2.3: Luminal, intraluminal and intramural; Subgroup 1.3: Luminal and intramural.

In the present case the luminal areas of the tumour satisfied Vickers & Gorlins criteria (1970) with presence of prominent subepithelial hyalinization. The intraluminal ameloblastomatous proliferation resembled plexiform pattern. The intramural ameloblastoma tissue was seen as an infiltration from the cyst lining or as free islands of follicular solid multicystic ameloblastoma (SMA), often with central cystic degeneration.

Due to the presence of mural proliferations tumour should be treated aggressively in the same manner as the classic SMA (Stoelinga & Bronkhorst 1988).

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Case Report

Maxillary First Molar with Three Canals in Mesiobuccal Root – A Case Report

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Abstract:

Knowledge of internal dental morphology is a complex and extremely important for planning and performing endodontic therapy. Proper location of additional canals in roots, especially of maxillary first molar, is very fundamental in high rate success of root canal therapy. This article describes the identification and treatment of a maxillary first molar exhibiting three canals in the mesiobuccal root.

Key Words: Mesiobuccal root, three root canals, cleaning & shaping.

Introduction:

The main objectives of root canal therapy are thorough shaping and cleaning of all pulp spaces and complete obturation of these spaces with an inert filling material. The presence of an untreated canal may be a reason for failure. It is extremely important that clinicians use all the armamentaria at their disposal to locate and treat the entire root canal system.

The mesiobuccal root of the maxillary first molar has generated more research and clinical investigation than any other root in the mouth. Weine et al (1969) reported that the mesiobuccal root of the maxillary first molar looks very slender when viewed in a mesiodistal direction, as it is often seen radiographically. However, it appears very broad when viewed in a faciolingual direction. He believed that many treatment failures in the maxillary permanent first molar were related to not locating, and cleaning the mesiopalatal canal. Pomeranz & Fishelberg (1974) discussed the importance of improved access and thoroughly probing the fissure or groove between the mesiobuccal and the palatal canals to locate the mesiopalatal canal. Ferguson et al (2005) reported a case of three canals in the mesiobuccal root of a maxillary first molar by troughing the fissure between the mesiobuccal and the palatal canals with a no. 2 round bur.

The purpose of this article is to report a rare case of maxillary left first molar that presented three root canals in the mesiobuccal root that was managed with successful endodontic therapy.

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Case Report:

A 28-year old male patient was referred for endodontic treatment for tooth number 26 to the department of conservative dentistry and endodontics, Peoples College of Dental Sciences and Research Centre, Bhopal. The tooth was restored with amalgam restoration three years back and had become symptomatic. The periapical radiograph showed periapical radiolucency involving the palatal root. After local anaesthesia, coronal access was obtained. Patient had not permitted rubber dam placement due to severe gag reflex, so endodontic files were used with dental floss. Further measures for isolation were taken to prevent contamination of root canal (Carrotte, 2004). Initially, the mesiobuccal, distobuccal, and palatal canals were located. Subsequent widening of the access cavity and probing with #10 k-file (Dentsply – Maillefer) resulted in locating two additional mesiobuccal canals (Fig.I).

A working length radiograph confirmed the presence of three separate canals in the mesiobuccal

Fig. I: Clinical view of access cavity showing orifices of three mesiobuccal canals.

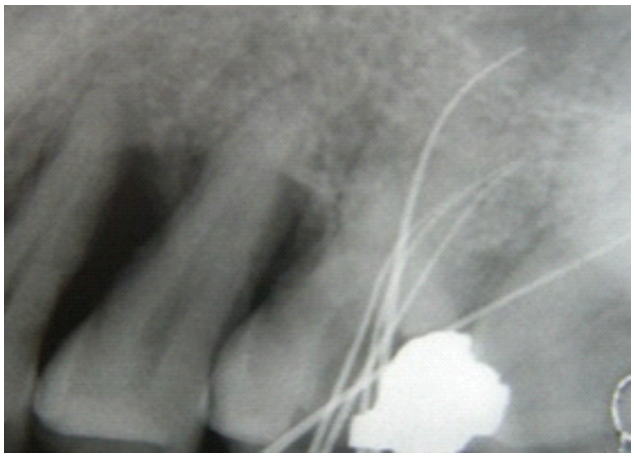

Fig.II: Radiograph showing all five canals. Amongst three mesiobuccal canals, two lingual most canals appears to join short of apex.

root (Fig. II). The two lingual most canals appear to join just short of the apex, while the buccal canal appears to have its own apical foramen.

Thereafter, the canals were chemomechanically prepared by using Protaper Ni-Ti rotary files (Dentsply – Maillefer), and 2% sodium hypochlorite as irrigating solution. The canals were flushed with 17% EDTA for 3 minutes under continuous stirring with no. 15 k-file, rinsed, dried, medicated with calcium hydroxide and the access cavity was closed with Cavit. Three days later, the canals were emptied, copiously flushed with 2% sodium hypochlorite and dried with absorbent paper points. The canals were obturated with Protaper Universal Gutta percha points and AH Plus endodontic sealer (Dentsply– Maillefer). The post operative radiograph was taken to confirm the completeness and extension of root canal fillings (Fig.III).

The old amalgam restoration was removed and an amalgam core was built up. The patient was referred to the department of prosthodontics for full coverage restoration. The patient was monitored clinically and radiographically to ensure a satisfactory periapical response.

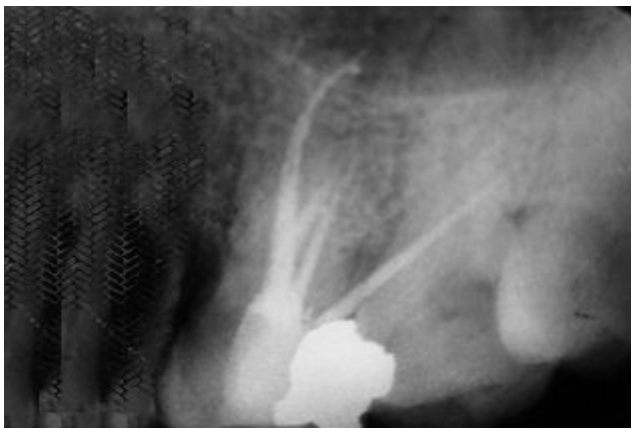

Fig.III: Post operative radiograph.

Discussion:

The variation in dental anatomy plays an important role in root canal therapy. Despite the current high success rate achieved in endodontic treatments, the mesiobuccal root is still associated with a considerable number of failures due to the difficulty in locating and obturating the second and / or third mesiobuccal canals (Vertucci, 1984; Fogel et al, 1994).

Whereas there have been numerous reports in the literature on the prevalence of mesiopalatal canals in the permanent maxillary first molar (Hartwell & Bellizzi, 1982; Kulild & Peters 1990), a third canal has been rarely reported (Ferguson et al, 2005). The third canal reported in this case was located without the aid of the surgical operating microscope. The fact that a third canal has been located in the mesiobuccal root of the maxillary permanent first molar underscores the need for thorough evaluation of canal anatomy during endodontic procedures. Undeniably, endodontists should continue to assume existence of additional canals until all measures have been exhausted in their location (Ferguson et al, 2005). The fact that this third canal was located without the use of a surgical operating microscope is noteworthy, and seems to agree with Sempira & Hartwell (2000). They evaluated whether a surgical operating microscope would increase the number of second mesiobuccal canals that could be located and obturated to within 4 mm of the root apex in vivo. They reported that the use of a surgical microscope did not increase the number of second mesiobuccal canals located, compared with those reports where access preparations were modified and the microscope was not used. However, Baldassari-Cruz et al (2002) evaluated 39 maxillary molars in vitro and concluded the surgical operating microscope did aid in identification of mesiolingual canal orifices. Burhley et al (2002) utilized an in vivo clinical setting to evaluate if surgical operating microscope and/or dental loupes enhanced the ability of endodontists to locate mesiolingual canals in maxillary molars. They found that those practitioners using the microscope, located a mesiolingual canal 57.4% of the time, and those using dental loupes 55.3% and when no magnification was used, a mesiolingual canal was located only 18.2% of the time. Wolcott et al (2002)

examined 1873 conventionally treated and retreated maxillary molars. They noted a significant difference in the incidence of mesiopalatal canals located during initial treatments and retreatments.

The young age of the patient involved in this case could have played a role in the relatively easy identification of the third canal without the use of a surgical operating microscope (Ferguson et al, 2005). However, the use of magnification is essential to ensure the long-term success of endodontic therapy in maxillary molars (Wolcott et al, 2002).

Conclusion:

A case of maxillary left first molar with three canals in mesiobuccal root is reported with successful obturation. It is important from the endodontist's point of view to judiciously locate all possible canals with understanding of variations in morphology of root canal system. This will help to achieve the long term success of the endodontic therapy and ultimate benefit to the patient.

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Case Report

Methods for Identification of Complete Dentures

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Abstract:

A simple method of placing a computer generated identification label on complete dentures has been described in the article. The equipments required are a computer printer and a film of transparency sheet. The denture labeling can be done with prefabrication or postfabrication technique.

Key Words: Cyanoacrylate adhesive, Denture label, Denture identification marking.

Introduction:

Denture identification systems are important for hospitalized patients, patients in long-term care facilities, for forensic identification purposes and other social reasons (Ling, 1998; Lamb, 1992; Coss & Wolfaardt, 1995). After major disasters such as earthquakes, fires or floods, accurate & early identification of the dead & injured becomes of utmost importance. At times the only identifiable remains are a victim's partial or complete dentures (Berry et al, 1995).

Our aging society, with the resultant growth in nursing home & hospital populations has increased the need for the easy identification of the prosthetic devices to be permanently labeled (Berry et al, 1995). Denture labeling is becoming more important each day as air travel and tourism are increasing. Regulatory bodies have recommended that all the prosthesis to be marked with an identification system, several techniques have been used in private & commercial laboratories to identify dentures (Ling, 1998).

Some procedures involve placement of a prepared label in the denture during fabrication. These involve an engraved, stamped metal or acrylic resin strip, disk, chip or printed paper, which is incorporated into the denture base during the flasking and/or packing process (Ling, 1998). These 'prefabrication techniques' are more permanent, but act as points of weakness, unless they are bonded to the acrylic resin (Lamb, 1992).

Under post-fabrication techniques, the less sophisticated technique includes simple engraving of the denture base with a dental bur or an electric engraver or placement of an ink tattoo. More sophisticated postfabrication techniques differ only in the material & methods used to seal the labels after they have been placed in the prepared recess. The use of clear autopolymerizing resin to overlay the label is the most popular technique. A quicker & easier procedure that uses light-cured resin instead of autopolymerizing resin eliminates the need for a pressured curing unit (Berry et al, 1995).

The importance of denture identification was brought into focus by Dr. Robert H. Griffiths during his tenure as a President of American Dental Association (Stevenson, 1987).

Stevenson in 1987 suggested the use of tape wrapped disposable blade to cut the patient's name or social security number in straight lines on buccal surface of the distobuccal flange & then rubbing lead pencil or ink pen over fine grooves to make them more evident. He also suggested an alternate procedure, wherein a sharp lead pencil could be used for writing name or numbers on the dry tissue surface of the denture. His opinion for the method was that it would require frequent remarking, possibly every 3 to 4 weeks & would be method of choice for short-term hospitalized patients.

Heath et al (1988) mentioned a technique in which the roughened surface of a finished denture could be temporarily marked with a fiber-tip pen & these marks could be protected against abrasion with layers of sealant.

Oliver (1989) advised the use of partly polymerized denture resin strips that unite to the base after curing. For protection of marks against abrasion he suggested a further resin layer placement over the label before final polishing.

Fiske et al (1986) mentioned a permanent method, which involved cutting a channel in the denture & either marking the base or inserting a marked strip. The channel was then refilled with autopolymerising

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acrylic resin. He had an opinion that the legibility detoriates as a result of interaction between acrylic resin monomer & some inks.

Lamb (1992) published a simple method for permanent identification of dentures. In this technique he mentioned the use of 4 to 5 mm wide clear autopolymerising acrylic resin sheets roughened on one side. The patient's name & postal code or other identification marks were written backwards on the roughened side using a fine fiber-tipped pen. After trial closure, the marked label was placed with ink-side down in the chosen place before closing the flask & processing normally.

Berry et al (1995) suggested a post-fabrication technique for identification of prosthetic devices. They designed a special bur to prepare an ideal preparation site in the denture base. The identification label bearing the patient's name, initials, driving license or social security number was computer generated in an easy to read font style of 4 or 5-point font size. The label was placed in 4 mm wide & 1 mm deep slot in the denture. One drop of monomer was placed onto preparation site before final placement of the label. A small brush was used to place small increments of saturated clear resin polymer. The prosthesis with label facing upwards was then placed in the plaster bowl filled with warm water & cured in a pressurized unit (20 psi) for 15 to 20 minutes.

They also suggested an alternatative procedure in which a special light polymerized Triad gel (Triad VLC system, Dentsply International) could be used in place of orthodontic resin.

Coss & Wolfaardt (1995) mentioned a denture identification system where a labeling machine was used to print a label on 9 mm or 12 mm tape. The label was inserted in the lingual flange of mandibular denture & posterolaterally in the palate or buccal to the tuberosity of maxillary denture. Autopolymerising acrylic resin was placed over the label & cured in a pressure-curing unit.

Ling (1998) suggested a computer-printer denture microlabelling system. Patient's personal identification information such as name, sex, national identification card number & country of origin was computer printed using a character of 8-point font size. The label was then photocopied onto a transparency in 50% reduced size & chemically treated with cyanoacrylate acid esters adhesive solution. The microlabel was then incorporated into denture during the packing stage or alternatively the microlabel could be incorporated after the denture fabrication.

This article describes a simple method for identification of dentures, which could either be used as a prefabrication or postfabrication technique.

Technique:

1) Type the patient's name, age, sex, and date of denture insertion in a computer in 8-point font style.
2) Type the doctor's initials & college/clinic name for easy identification at the recall visits in the same college/clinic.
3) This information is to be printed on an overhead transparency sheet. The sheet is cut into adequate size (Fig. I). Cyanoacrylate adhesive (Fevi Kwik, India) is placed over the printed matter (Fig. II). Care is taken not to rub the adhesive over the marked portion & a same size blank transparency sheet is placed over it. By doing this the printer toner is placed away from the monomer of denture base resin. Thus the detoriation of legibility is reduced. The two joined sheets are cut with sharp scissors for restricting the size of label (Fig. III). Now the printed identification label is ready for prefabrication or the postfabrication denture identification technique.

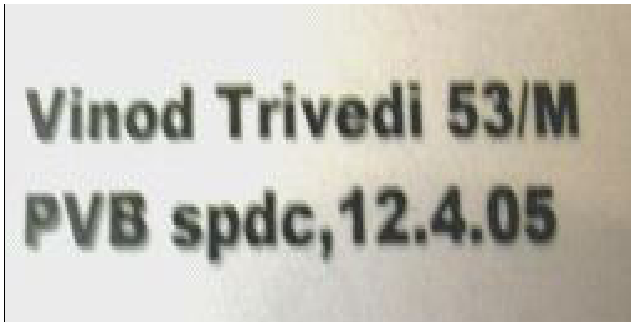


Fig. I: Adequate size of printed transparency sheet is cut

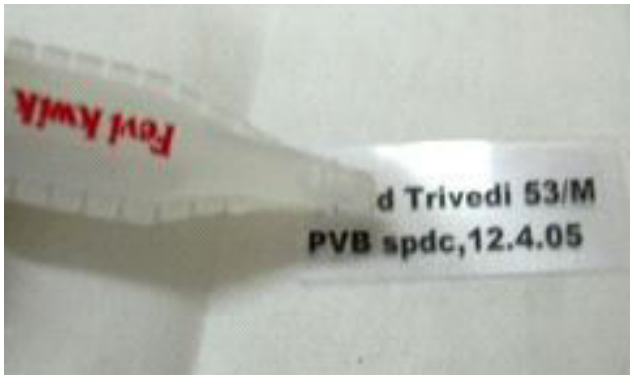


Fig. II: Cyanoacrylate resin Adhesive is placed to cover the label with second layer of transparency sheet.

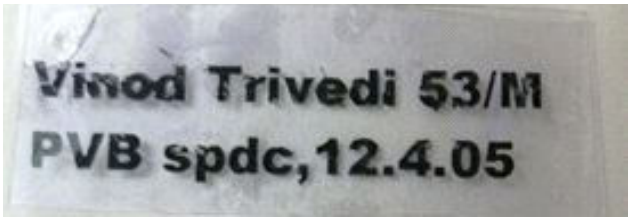
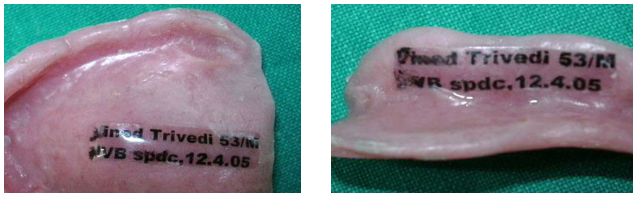


Fig. III: Two joined sheets are cut to make the borders even & smooth.

(a) Maxillary (b) Mandibular

Fig. IV: Label is placed after Trial closure.



(a) Maxillary (b) Mandibular

Fig. V: Label seen after Denture processing.

4) In a prefabrication technique, the label is placed over the denture base resin after trial closure (Fig. IV). The denture is processed in a normal way (Fig. V).
5) In postfabrication technique, a slot of 1 mm deep is prepared on the finished surface of denture base, which is in approximate size of the label (Fig. VI). One drop of cyanoacrylate is placed in slot to properly position the label. Over the label, clear autopolymerising acrylic resin is mixed & placed in small increments. After the initial set, the denture is placed in warm water for about 10 minutes. The denture is removed & polished (Fig. VII).
6) The denture is then inserted in the patient's mouth.

Fig. VI: Size of the bur is selected according to that of label size & slot preparation is done.

Fig VII: In Postfabrication method, Clear acrylic resin is placed over the label for better visibility.

Discussion:

One of the important criteria for any denture identification system is the protection of the label-ink or toner. It has to be protected from the monomer of the denture base resin, the high temperatures of denture processing, finishing & polishing of dentures & wear of the dentures (Ling, 1998). The Prefabrication techniques are more permanent, but act as points of weakness unless they are bonded to the acrylic resin (Lamb, 1992). Lamb's technique of 4 to 5 mm wide clear autopolymerising acrylic resin sheets can cause problem while closure of flask, as it is not flexible as compared to transparency sheet & so it cannot be packed with even layering of acrylic resin during final closure (Lamb, 1992). Thus it is a technique sensitive procedure.

On the other hand Postfabrication techniques are quicker & easier as compared to the prefabrication methods.Stevenson's technique of rubbing lead pencil or ink pen over fine grooves to make them more evident is not a permanent method & may fade after subsequent use of denture. It would require frequent remarking, possibly every 3 to 4 weeks. Advantage of this method is that, it can be used for short-term hospitalized patients (Stevenson, 1987).

The technique described by Heath et al (1988) is a temporary method & the denture has to be remarked & layers of sealant have to be reapplied on a regular basis which may depend on patient's use.

Fiske's technique showed that the legibility of written material detoriates as a result of interaction between acrylic resin monomer & some inks (Fiske et al, 1986).

Ling (1998) technique does not mention about protection of toner in the microlabel prompting usage of two sheets of transparency sheet in the described technique.

The technique reported by Berry et al (1995) for identification of prosthetic devices with an alternate procedure using Triad gel (Triad VLC system, Dentsply International) is the best regarding polymerization shrinkage but requires expensive investment of material & curing chamber which may be not possible in every clinic (Berry et al, 1995).

In the suggested technique the toner is properly covered in two sheets of transparency using cyanoacrylate adhesive. Thus the longevity of the denture label is obtained. The procedure is easy to use & is very cost effective, as it uses equipment that are available in any institution or office. The transparency sheet can be used again until it is fully used up (Ling, 1998).

The label, besides carrying information about the patient, also has the date of insertion, name of the doctor who has worked over it & the name of college/ clinic. This would give a clear indication of the age of denture through which it is easy to identify the wear of denture, & oral hygiene procedures & maintenance of the dentures. Secondly the name of the doctor also helps for easy search for patient's data from records that would be helpful in an institution/clinic.

The prepared label can be inserted into denture by prefabrication & postfabrication technique. In prefabrication technique the label is inserted on the intaglio surface after trial closure of denture flasks. The intaglio surface is the area where least adjustment is done during denture insertion. The background of the label is clear & only the black markings of the label can be clearly seen even after relining of dentures, if required, at further appointments (Ling, 1998).

In postfabrication technique the label is inserted in a preparation site, which is located in the flattest portion on the cameo surfaces of the lingual flange of the mandibular denture and/or palate of the maxillary denture. These sites do not interfere with esthetics of the denture. Generally these sites are acceptable for the patient. These areas are also not removed during postinsertion adjustments or routine relining procedures (Berry et al, 1995). Added advantage of this technique is that the identification label appears on the denture tissue surface covered by a layer of clear acrylic resin thick enough to resist normal cleansing & even some surface loss if adjustment is required (Lamb, 1992).

Summary & Conclusion:

This article describes easy to use & very cost effective way of denture labeling.. The added information about the date of denture insertion, name of doctor & the institution/clinic is helpful at the recall visits. The equipments required are easily available in any institution, dental laboratory or dental clinic.

By this method denture labeling could be done in existing prosthetic devices which were not labeled previously or it could be incorporated in newly constructed prosthesis.

The procedure could be easily performed by dental auxiliary personnel thereby reducing workload for the dentist.

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Review Article

Periodontal Disease and Diabetes - A Two Way Street Dual Highway?

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Abstract:

Periodontitis is considered to be the sixth most common complication of diabetes. There is a two way relationship in which periodontal disease has adverse impact on glycemic control and in turn diabetes exaggerates periodontal infection, affecting the overall general health of an individual. In this article we have tried to review the recent research developments and mechanisms by which both diabetes and periodontal disease cause mutual destruction. Our aim of this article is to make aware, both general dental and medical practioner about interrelationship between periodontal disease and diabetes with special emphasis on importance of mutual consultation between the two fraternity, which in turn significantly contributes to general well being of an individual.

Key Words: Diabetes, Periodontitis, Amadori Product, AGE's.

Introduction:

Periodontitis has been defined as an inflammatory disease of supporting structures of teeth, of specific bacterial origin which progress with episodic attachment loss. The destructive process of periodontitis is thought to begin with the accumulation of biofilms which contain significant bacterial masses on the tooth surface at or below the gingival margin (Gibbons & Van-Houte, 1980). Continued destruction is thought to occur as a result of the host inflammatory response against these bacteria and from release of toxic products from the pathogenic plaque.

Studies conducted by National Center for Health Statistics & National Institute of Dental and Craniofacial Research have spurred researchers in the dental community to investigate the possibility of risk factors other than bacterial plaque which would exacerbate and perpetuate the progression of periodontal disease (Miller et al, 1987; Brown & Löe, 1993). There is at present a rapidly increasing evidence which has implicated a variety of systemic diseases such as diabetes, HIV, inherited chromosomal disorders, environmental factors, behavioral influences and osteoporosis as playing important roles in development and progression of periodontal disease. There is a strong relationship between periodontal health or disease and systemic health or disease. This means a two way relationship in which periodontal disease in an individual may have powerful influence on individual's systemic health or disease as well as most customary understood role that systemic disease may have an influence on individual's periodontal health or disease (Dumitrescu & Inagaki, 2010).

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Diabetes Mellitus:

Diabetes mellitus is a disease of metabolic disregulation, which develops from either a deficiency in insulin production (IDDM) or impaired insulin utilization (NIDDM). It is characterized by the classic triad of symptoms like polyuria, polydipsia and polyphagia.

Insulin dependent diabetes mellitus (IDDM) results from the destruction of the insulin producing β cells of the pancreas which may involve an autoimmune or a virally mediated destructive process. Non insulin dependent diabetes mellitus (NIDDM) results either from defects in insulin molecule or from altered cell receptors for insulin and manifests as insulin resistance rather than insulin deficiency (Szopa et al, 1993; Atkinson & Maclaren, 1990; Current Concepts, 1999).

Classic complications of diabetes include retinopathy, nephropathy, neuropathy, cardiovascular disease and impaired wound healing. Periodontal disease is considered as the sixth greatest complication of diabetes (Löe, 1993).

The diagnosis of diabetes is based on criteria established by American Diabetes Association -2005 and involves the use of either fasting blood glucose levels or two hour postprandial levels or oral glucose

tolerance tests. Since single abnormal lab test is not sufficient to establish a diagnosis, any positive value must be confirmed on different day: 1) Symptoms of diabetes like polyuria, polydipsia, unexplained weight loss, and Casual (any time after last meal) plasma concentration of ≥ 200mg/dl. 2) Fasting (no caloric intake for 8 hours) plasma glucose ≥ 126 mg/dl. 3) Two hour post load glucose ≥ 200 mg/dl during an oral glucose tolerance test. The test is performed using a glucose load containing the equivalent of 75gm anhydrous glucose dissolved in water. The normal fasting plasma glucose level is < 100 mg/dl. Impaired fasting glucose is diagnosed when fasting plasma level of glucose is ≥ 100 mg/dl but ≤ 125 mg/dl. Normal post load glucose is < 140 mg/ dl. Impaired glucose tolerance is diagnosed when 2 hour post load plasma glucose is ≥ 140 mg/ dl but ≤ 199 mg/ dl. (Mealey & Oates, 2006).

Oral manifestations of diabetes mellitus:

There is evidence demonstrating that some of the commonly occurring signs and symptoms of diabetes occur in oral cavity. Depending on the age of the patient, duration of disease, and control or management of disease, the oral manifestations can vary from normal to severe.

Uncontrolled diabetes:

- Chelosis and tendency towards drying and cracking.
- Burning sensation in mouth or tongue due to xerostomia or candidiasis.
- Decrease in salivary flow, leading to increased caries rate.
- Oral mucosa is red, edematous and ulcerated
- Most striking changes are the reduction in defense mechanisms and increased susceptibility to infections leading to destructive periodontal disease.

Controlled diabetes:

In well controlled diabetes none of the previously mentioned changes are found. Accumulating data regarding the effect of diabetes on oral cavity suggest that oral tissues are adversely affected by uncontrolled diabetes similar to other body systems and increased susceptibility to oral infections including gingivitis, periodontitis and delayed wound healing (Mealey, 1999).

Diabetes and Periodontal Disease:

Periodontitis in IDDM starts to appear after the age of 12 years, with higher prevalence in older individuals, whereas in NIDDM patients have higher prevalence irrespective of their age. Patients showing overt diabetes over a period of more than 10 years have greater loss of periodontal structures, than those with a diabetic history of less than 10 year (Papapanou, 1996).

Periodontal disease is most consistent finding in poorly controlled diabetic patients. Approximately 75% of these patients have periodontal disease with increased alveolar bone resorption and inflammatory gingival changes. Diabetics, whose diabetes is under good control are also found to have a higher incidence and greater severity of periodontal disease.

Individuals with poorly controlled diabetes present with increased gingival bleeding, enlarged gingiva, sessile or pedunculated gingival polyps, increased probing depths, increased attachment loss, increased tooth loss, increased alveolar bone loss and tendency towards abscess formation (Mariotti, 1999). Periodontal disease is more frequent and severe in diabetic individuals with more advanced systemic complications, which does not correlate with increased levels of plaque and calculus (Bacić et al, 1988).

The mechanism by which diabetes mellitus contributes to development of periodontitis remains unclear although several mechanisms have been proposed. Prolonged exposure to hyperglycemic condition results in decreased fibroblast proliferation, decreased collagen synthesis, enhanced collagen glycosylation and cross linkage resulting in defective collagen metabolism and normal collagen is replaced with highly polymerized and cross linked collagen. Increased collagenase activity results in excess removal of gingival collagen fibers. Vascular basement membrane thickening and alteration, narrowing of the lumina of the capillaries and precapillary arterioles and vascular degeneration of the gingiva leading to reduced oxygen consumption and oxidation of glucose. These angiopathies contribute to compromised delivery of nutrients to the surrounding tissues and poor elimination of waste products necessary for maintenance of gingival tissues (Krejci & Bissada, 2000). All the above mentioned mechanisms contribute to aggressive removal of connective tissue and severe periodontal destruction.

It has been recently demonstrated that in diabetics, an upregulated proinflammatory monocyte

response results in enhanced production of cytokines, like tumor necrosis factor- α (TNF -α) interleukin 1- β (IL 1β) and prostaglandin E2, which is linked to increased severity of periodontal disease. These factors strongly suggest that, in diabetes a number of abnormal host effecter mechanisms converge to lead to a range of complications (Grant-Theule, 1996).

Important link between all of these changes and the subsequent development of the major complications of diabetes is the glycosylation of proteins, lipids and nucleic acids (Vlassara, 1994; Brownlee, 1994). The hyperglycemia mediated formation and accumulation of these proteins are known as (AGEs) Advanced Glycation End products (Brownlee, 1994; Brownlee & Cerami, 1981). AGEs are chemically irreversible proteins which have been altered by the non enzymatic addition of hexoses and form slowly and continuously in hyperglycemic condition (Brownlee, 1992). Formation of AGEs begins with the attachment of glucose to amino groups of proteins to form an unstable Schiff base products. Through a slow chemical rearrangement, these are converted to a more stable but still reversible glucose protein products known as amdori product. Normalization of hyperglycemia at this stage results in reversible amdori product. If hyperglycemia is sustained the amdori product becomes highly stable and form AGEs which are irreversible. Thus even if hyperglycemia is corrected, the level of AGEs in the affected tissues does not return to normal (Vlassara, 1994; Brownlee, 1994; Monnier et al, 1996). AGEs form and accumulate in number of circumstances such as ageing, renal failure and uncontrolled diabetes. Accumulation of AGEs in the tissue may result in significant alteration of normal cellular composition and structure. With the alteration of many body proteins such as collagen, hemoglobin, plasma albumin, lens proteins and lipoproteins, come an alteration in their respective functions. In addition to apparently receptor independent mechanisms, AGEs may directly interact on cell surfaces at receptor for AGEs (RAGE), a member of immunoglobulin super family of cell surface molecules. In normal individuals RAGE is present at low levels in a number of cell types including endothelial cells, smooth muscle cells, neurons and monocytes (Schmidt et al, 1994 & 1996; Vlassara & Bucala, 1996). However, in perturbed states, such as diabetes, the expression of RAGE on critical cell is strikingly enhanced. The interaction of AGEs with monocyte RAGE results in increased cellular oxidant stress that leads to enhanced chemotaxis and activation of monocytes with resultant release of four times more of pro inflammatory cytokines IL- 1, and twenty four to thirty two times of TNF- α compared to normal individuals (Schmidt et al, 1994 & 1996; Kirstein et al, 1992; Vlassara et al, 1988). Interaction of AGE with fibroblast RAGE results in decreased production and remodeling of collagen (Lalla et al, 2000).

Effects of AGEs on Periodontium:

AGEs accumulate twofold in human diabetic periodontium as compared to other tissues. This accumulation plays an important role in the pathogenesis of diabetes associated periodontitis. Increased accumulation of AGEs and their interaction with RAGE in diabetic gingiva leads to vascular dysfunction and hyperpermeability, loss of effective tissue integrity and barrier function, alteration, immobilization and activation of mononuclear phagocytes, critical mediators in generation of proinflammatory cytokines and matrix metalloproteinase's (MMP's) (Lalla et al, 2000). Grossi and Genco have postulated that, if glucose mediated AGE accumulation altered the migration and phagocytic activity of mononuclear and polynuclear cells, a more pathogenic sub gingival flora would result (Grossi & Genco, 1988). With maturation and transformation, the subgingival flora would become more Gram –ve and in turn produce a source of chronic systemic challenge through the ulcerated pocket epithelium. This chronic infection further trigger cytokine upregulation especially TNF-α and IL-1 leading to further connective tissue degradation and destruction.

Influence of Periodontal Infection on Diabetes:

Studies have shown that diabetic patients with periodontal infection have a greater risk of worsening glycemic control overtime compared to diabetic subjects without periodontal disease (Taylor et al, 1996). Periodontal interventional trials have suggested a significant potential metabolic benefit of periodontal therapy in patients with diabetes (Mealey & Ocampo, 2007). Several studies of diabetic subjects with periodontitis have shown improvements in glycemic control following scaling and root planing combined with adjunctive systemic doxycycline therapy. The magnitude of change is often about 0.9 to 1.0% in HbA1c test(glycosylated hemoglobin) (Miller et al, 1992; Grossi et al, 1997). Studies have shown that systemic infections such as viral or bacterial infections

increase insulin resistance and have adverse impact on glycemic control (Yki-Järvinen et al, 1989; Sammalkorpi, 1989). Recent evidence suggest that chronic infections like periodontitis may induce a chronic state of insulin resistance which would then result in poor glycemic control which would contribute to the cycle of hyperglycemia, non enzymatic irreversible glycation, AGEs of protein binding with further accumulation (Nishimura & Murayama, 2001; Mealey & Oates, 2006). Blood levels of TNF-α, IL-6 and C-reactive proteins (pro inflammatory cytokines) are increased in patients with diabetes especially in those with periodontal disease (Noack et al, 2001). Monocytes from patients with diabetes produce 24 to 32 times increase level of TNF α, when stimulated by periodontal pathogen than do monocytes from subjects without diabetes (Salvi et al, 1997). TNFα is an antagonist to the cell surface insulin receptor substrate (IRS-1), which inhibits phosphorylation and translocation of insulin receptor (Ling et al, 1994). Resulting inhibition of intracellular glucose transport and insulin action contributing to insulin resistance. This explains why periodontitis increases the risk of poor glycemic control in patients with type 2 diabetes (Taylor et al, 1996), and may also explain why improvement in glycemic control has followed periodontal therapy in studies of diabetic subjects (Miller et al, 1992; Stewart et al, 2001). Thus periodontal treatment may reduce inflammation locally and also decrease serum levels of the inflammatory mediators that may cause decreased insulin resistance thereby positively affecting glycemic control (Iwamoto et al, 2001). Thus relation between periodontal disease and diabetes may be a two way street, a dual highway of catabolic response and tissue destruction resulting in more severe periodontal disease and less glycemic control (Fig. I). Various mechanisms of diabetic influence on periodontium explained in Fig. II.

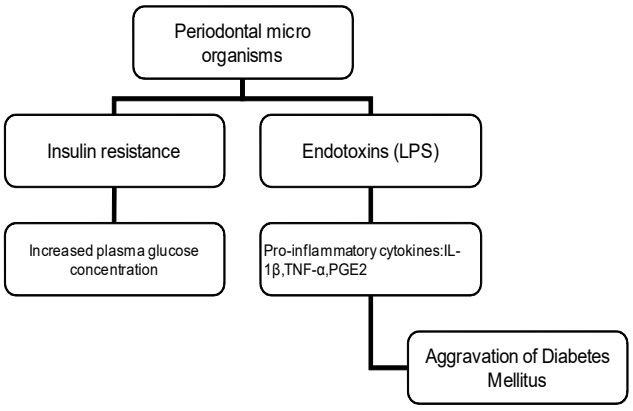

Fig. I: Mechanisms by which periodontitis may influence diabetes mellitus

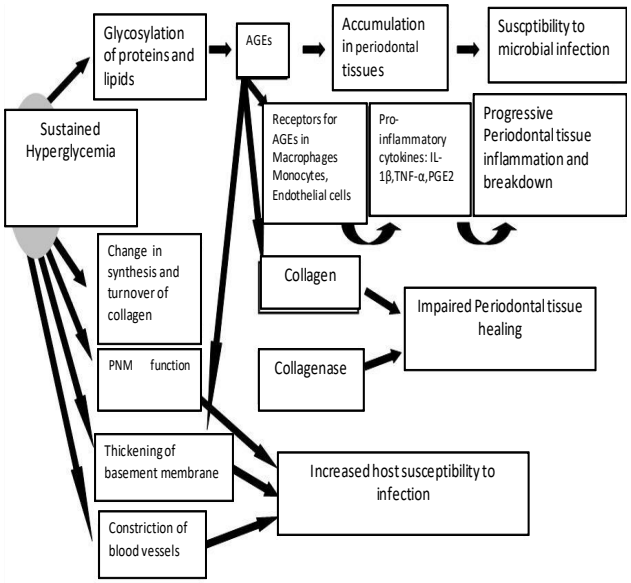

Fig. II: Mechanisms by which diabetes may influence periodontal disease.

Table I: Periodontal maintenance for well controlled diabetes.

Patient characteristics	Periodontal maintenance	Frequency
Healthy periodontium;no or minimal localized gingivitis	Record probing depths and bleeding score; deplaque	Annually
Healthy periodontium, generalized gingivitis	Record probing depths and bleeding score; deplaque, OHI	Annually
Chronic, mild to moderate periodontal disease	Record probing depths and bleeding score; deplaque, OHI	3 to 4 months
Advanced attachment loss	Refer to periodontist, monitor, record probing depths & bleeding score, deplaque, OHI	3 to 4 months

Table II: periodontal maintenance for poorly controlled diabetes.

Patient characteristics	Periodontal maintenance	Frequency
Healthy periodontium;no or minimal localized gingivitis	Record probing depths and bleeding score; deplaque, OHI	Every 6 months
Healthy periodontium, generalized gingivitis	Record probing depths and bleeding score; deplaque, OHI	Every 4 to 6 months
Chronic mild to moderate periodontitis	Refer to periodontist, monitor, record probing depths & bleeding score, deplaque, OHI	Every 4 to 6 months
Advanced or aggressive periodontitis	Refer to periodontist, monitor, record probing depths & bleeding score, deplaque, OHI	Every 3 months

Diabetes and Gingival Crevicular Fluid (GCF) Glucose Levels:

Increased blood glucose results in increased levels of gingival crevicular fluid (GCF) glucose. Invitro studies have shown decreased chemotaxis of

periodontal ligament fibroblasts to platelet derived growth factor when placed in hyperglycemic environment (Nishimura et al, 1998). Thus elevated GCF glucose levels adversely affect periodontal wound healing.

Periodontal Vasculature:

Changes affecting renal, retinal vasculature, also affect periodontium in diabetes. Increase in thickening of gingival capillary endothelial cell basement membrane and wall of small blood vessels takes place. This impairs oxygen diffusion and nutrition provision across basement membrane which alters normal tissue homeostasis leading to increased severity and progression of periodontal disease (Frantzis et al, 1971; Listgarten et al, 1974; Seppälä et al, 1997).

Collagen Metabolism:

Increased collagen breakdown through stimulation of collagenase activity has been observed in periodontium of diabetic individuals. Collagenase primarily degrades more newly formed and therefore more soluble collagen macromolecules. Sustained hyperglycemia results in AGE modification of existing collagen with increased cross linking. This results in rapid degradation of recently synthesized collagen by host collagenase and predominance of older highly cross linked modified collagen. Since collagen production and degradation exist as a highly balanced homeostatic mechanism, change in collagen metabolism result in altered wound healing. Impaired wound healing is a well recognized complication of diabetes and may affect any tissues including periodontium (Ramamurthy & Golub, 1983).

The cytokines also effect the increased production of MMPs by major cell types of periodontium. MMPs are responsible for increased bone resorption and connective tissue breakdown (Ryan et al, 1996).

Management:

The goal of diabetes control should be aimed at glycemic control regulation as evidenced by diabetes control and complications trial (DCCT, 1986), in which through intensive insulin therapy, the risks of development and/or progression of existing retinopathy, nephropathy, neuropathy and severity of periodontal disease were reduced significantly. The American diabetes association recommends vigorous glycemic control for patients in the NIDDM category as well.

The initial dental therapy for patients with diabetes mellitus as with all patients should be directed towards control of all acute oral infections, at the same time, communication may be established with the patients physician so that a plan can be developed to obtain control of blood glucose levels. It is important to advise the physician of the periodontal status, since the presence of infections, including advanced periodontitis may increase insulin resistance, and contribute to worsening of diabetic state. Several studies have shown that control of periodontal infection through mechanical therapy combined with systemic antibiotics improve glycemic control leading to reduced requirement of insulin in insulin dependent diabetes mellitus patients (Stewart et al, 2001; Darré et al, 2008; Madden et al, 2008). As above studies have demonstrated that control of periodontal disease can enhance glycemic control, it would seem logical to include periodontal disease control as an integral part of diabetes management. It is also necessary to study what type of periodontal therapy, like mechanical debridement, surgical or local drug delivery reduces circulating AGEs and TNFα levels and whether blocking of TNFα with neutralizing antibodies is effective in improving insulin resistance without conventional periodontal therapy (Tan et al, 2006).

Guidelines for Dentist and Periodontist:

Prevention and control of periodontal disease must be considered as an integral part of diabetes control. The principles of treatment of periodontitis in diabetic patients are the same as those for non diabetic patients. Major efforts should be directed at preventing periodontitis in patients who are at risk of diabetes. Diabetic patients with poor metabolic control should be seen more frequently especially, if periodontal disease is already present. Periodontist should understand the diagnostic and therapeutic modalities used in diabetes care. They should thoroughly understand the pharmacologic agents commonly used to treat diabetes and the risk, they pose in the form of hypoglycemia and its treatment in dental clinic is a must. It is the duty of periodontist to educate both patient and physician about interrelationship between periodontal health and glycemic control with emphasis on inflammatory nature of periodontal disease and potential systemic effects of periodontal infection (Table I & II; Matthews, 2002).

Summary:

Ensuring oral health in patients with diabetes requires an expanded scope of medical and dental knowledge. There is undoubtedly a close relationship exists between diabetes and periodontal disease, a relationship requiring further study and exploration. Diabetes increases the risk of periodontal destruction, especially in patients having poor glycemic control. These patients are most likely to report to dental office with significant periodontal treatment needs. All diabetic patients should have routine peridontal evaluation and preventive therapy. The practioner, who understands the role of diabetes in etiology of oral diseases, the potential for oral infections to influence glycemic control, the current medical therapeutic approaches to diabetes and implications of diabetes on dental care provides patient with the best chances of successful treatment outcomes.

As health care professionals, we need to be more cognizant of interrelationship between diabetes and periodontal disease. The time has come for all medical and dental practioners to practice at a heightened level of awareness regarding interrelationship between diabetes mellitus and periodontal disease. The best treatment protocol includes referral of patients to respective specialists like diabetologist and periodontist for specific treatment concerns.

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